Restoration of the Angel of the Lilies

By

Louis C. Tiffany

A Proposal to Amherst's
Community Preservation Act Committee

From

The Unitarian Universalist Society of Amherst

December 1, 2012

Date: December 1, 2012

Submitting Entity:

The Unitarian Universalist Society of Amherst

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Overview of the Proposal:

The Unitarian Universalist Society of Amherst will need to raise $106,250 for the complete restoration and preservation of "The Angel of the Lilies," an historic window created by the studios of Louis Comfort Tiffany in 1890. In addition to extensive cleaning of dirt and soot that has accumulated between the layers of glass, the window requires re-leading. Lead has a life span of only 100 years, at which time it becomes fatigued; it cracks, expands and bows, accelerating its frail state and jeopardizing the existence of the entire window. This has happened to our Tiffany.

Window dimensions: 135" h x 108" w
Paint types: fired, etching and enamels
Glass type: Two to three layers of opalescent glass

When stained glass came into fashion in the United States in the 1830s, there was a limited palate of colors; most glass derived its hue from paint applied to the surface. John La Farge, a New York artist, traveled to England and learned that *plating* (putting one piece of colored glass on top of another) could create special color effects. Once home, he also realized that opalescent glass (a milky glass commonly used in vases) could absorb and reflect light in ways that created even more colors while adding a "drapery" effect.

His student Louis Comfort Tiffany would later plate two, three and up to five pieces of opalescent glass together, resulting in an "atmospheric" or "perspective" look. Tiffany went on to master this art, specializing in the folds of fabric in his figures.

The Tiffany Glass Studio produced four types of windows. Two types, those with floral or ornamental mosaic themes, were popular in homes. A third type, windows with Biblical figures, was often commissioned by churches. Paint applied to the surface of the glass was used to depict faces, feet and hands. The fourth and most costly type of window – the landscape, considered Tiffany's crowning contribution to the medium – was rarely

found in houses of worship. Amherst is fortunate to have a religious *and* landscape window in one at the Unitarian Universalist Society. The figure in Tiffany's Angel of the Lilies, clothed in drapery glass, stands before lilies and mountains beneath a sunset sky.

This window was commissioned for All Souls Unitarian Church in Roxbury, Massachusetts, in memory of Sarah Louisa Frothingham, the first wife of Henry Bigelow Williams. The Frothinghams were a large and prominent Boston family that produced several notable Unitarian ministers. A member of All Souls would later tell the Amherst Unitarians that the Angel's face was presumed to bear "a suggested likeness" to Sarah Louisa Frothingham, who was killed in a carriage accident at the age of 20.

The Angel window's nine panels were removed from All Souls in 1923, when the building was sold following that congregation's merger with the First Church of Roxbury. The American Unitarian Association put them into storage, along with another set of memorial windows from All Souls that had been created by La Farge.

That same year – 1923 – Unity Church in Amherst, built by the Universalists in 1893 and later purchased by the Unitarians, began an extensive renovation project. Work included the installation of a new floor of North Carolina pine in the social room in the basement. A fungus arrived with the pine, spread to wood elsewhere in the building and threatened to bring down the meetinghouse. The Rev. Henry Goodson Ives appealed to the American Unitarian Association for financial help in saving the building. Instead, he was offered the Tiffany and La Farge memorial windows that had been commissioned for All Souls in Roxbury, with the explanation that they might arouse interest in the larger Amherst community. They were installed in 1925 and received praise in newspaper articles covering the rededication of the meetinghouse that October.

Today, Unity Church – now called the Unitarian Universalist Society of Amherst – is once more embarking on a building project. An addition on the east side of the meetinghouse and upgrades to the existing structure are to commence in May 2013. Because the Angel of the Lilies must be removed for its own protection during this work, this is an ideal time to undertake the critically needed steps to preserve it for the benefit of future generations.

It should be noted that on an undetermined date in the future, we hope to replace or expand the sanctuary. This might involve either building a new structure attached to the 2013-2014 addition, with a west wall closer to North Pleasant Street than that of the current meetinghouse, or moving the existing western façade of the meetinghouse closer to North Pleasant Street and using it as the façade of a new sanctuary.

In either case, the look would be compatible with and honor the spirit of the historic Arts & Crafts design of the current meetinghouse. Similarly, the Tiffany would remain as a central feature of both our sanctuary and of downtown Amherst, still facing west and even more visible from North Pleasant Street than it is now.

Describe how your request meets the CPA criteria:

1 (a) Description of funding needed including:

UUSA has received two bids for removing, restoring and reinstalling the Tiffany window. The studios' proposals are included in the appendix.

- Nigel Johnson/Cohoes Glass - $126,750
- Roberto Rosa/Serpentino Studio - $123,520

Each of these estimates covers complete restoration including removal, crating, transportation, 100% restoration, reinstallation and protective glazing. Since these bids are close, we want to have the option of choosing the best studio based on our review of both. For this reason, we have used the higher bid in calculating what we need to raise in addition to funding already at hand.

1. (b) Other Sources of Funding

UUSA has $20,500 in reserved funds for restoring the stained glass windows. In addition we have begun a search for other sources of funding. So far that search has been discouraging. Religious organizations often don't qualify for funding or there are requirements for historic designation which we don't have.

It is important to realize that the Society has recently completed a very successful capital campaign which raised $769,000 to add to a major gift of $1,000,000 from one of our members. We currently have an estimate for the proposed addition that is roughly this amount ($1,827,000). Given the fact that our denomination's national association had estimated that a congregation of our size and income level could only raise $500,000, it is clear that our members have been very generous. It is our opinion that we cannot hold another capital drive for a number of years. Pledges from this drive can be paid over the next three years and we will continue to have to raise funds for the operational budget at the same time. Thus if the Tiffany window is to be restored and reinstalled when the addition is finished, we must seek funds from other sources besides the Congregation.

1. (c) Timeline for how CPA funds, if awarded, would be spent.

Current plans, recently ratified by unanimous vote at a Congregational Meeting, have us beginning construction in May 2013. These plans include some needed upgrades to the current structure requiring removal of the Tiffany window at that time. Given the fact that CPA funding would not be available until July 2013, we will use our reserved funds to pay for this cost. Then ideally restoration would begin in July, and the window would be ready to be reinstalled when the addition is finished (now anticipated to be February 2014), or shortly thereafter. Details of payments are found in each proposal.

1. (d) Timeline for spending funds.

Providing that we are successful in raising sufficient money to complete the project, we would like to spend the money entirely in FY 2014. If we are unsuccessful, we will still need to remove the window in May 2013. Our consultants have determined that it might be damaged during construction. We will then need to store the window until we acquire sufficient funding for the project. Until then, we will probably continue with a plywood covering over the window opening.

2. Urgency of the Project.

In 2006, UUSA hired Julie Sloan, a nationally renowned stained glass consultant, to conduct a detailed review of the window. That report is included in the appendix. As she said, "All of the windows are in very poor condition and should be restored as soon as possible." Her report has a very detailed analysis of the specific problems with the Tiffany. Both bidders who have examined the window concur that it is bad condition and needs repair as soon as possible.

As stated above, the window was created by the Tiffany Glass Company in 1890, and is an excellent example of Tiffany's "landscape" work, one of the rare examples found in a religious building. It is in fragile condition and must be removed during our planned construction. It has been the primary feature of the North Pleasant St. side of the Society since 1925 and certainly is one of the historical treasures of Amherst.

3. Estimated Timeline from Receipt of the Funds to Project Completion.

As stated above, the window will be removed in May 2013 and will be available for restoration to begin by July. Given sufficient funding, it will be fully restored and ready to be reinstalled in the spring of 2014.

4. Acquisition or Preservation of Threatened Resources.

As stated above, this grant is for the preservation of the Tiffany "Angel of the Lilies." It was installed in 1925 and is in poor condition. It is a magnificent window, and will continue to be a major historical and artistic resource for Amherst providing that we can raise the funds for its preservation. While we will continue to look for other sources of funding, our initial research has not identified any and so we assume that CPAC funding is essential if we are going to be able to reinstall the window anytime in the foreseeable future.

5. Population to be Served.

The Unitarian Universalist Society of Amherst is open to all, both for Sunday services and religious education, and to lay groups for concerts, lectures, ceremonies, meetings, pre-school education, and many other purposes. In addition we have a brochure (see the appendix) that is in the Chamber of Commerce office and have participated in the first Thursday Art Walks. Several members of the congregation are trained as docents and can provide an interesting introduction to the window.

The proposed restoration process includes a new protective glazing that will make the window much more visible from the outside in the evenings. (The current Plexiglas® over the window has darkened and discolored over time. Laminated glass will not darken or discolor.) We currently have the window backlit from inside the sanctuary, but the poor condition of the existing covering obscures much of the beauty of the window. With restoration complete, the citizens of Amherst will be able to enjoy it much more than has been possible for many years.

Also, the addition that will be built at the rear of the building next year will make the building much more attractive for multiple uses. We will be adding a social hall with a work area for caterers that will make the building available for events that provide refreshments. (This area will include the rough plumbing and other features that will allow it to be equipped as a commercial kitchen in the future.) Handicapped accessible bathrooms, a better access ramp, an elevator, and expanded classroom space on the lower level also will attract many more groups looking for meeting space in the center of Amherst than we have been able to accommodate in our current building.

6. Prioritization by Town Committees and Commissions.

UUSA first met with the Historical Commission in 2007 to inform it about our project. The members then were very supportive, but required us to be very clear that we were committed to staying in our current Amherst location. It has taken five years for us to gain congregational commitment to staying on North Pleasant St., to agree on a building design, to plan and successfully run a capital campaign, and to get updated bids on the window restoration project. We met again with the Commission in October 2012 to describe the project, and have requested a place on the December agenda for further discussion.

We hope very much to get a letter of support from the Historical Commission in the near future. In addition we would appreciate an opportunity to meet with the CPAC to answer questions and to provide any other information you may need to make a decision.

Appendix

1. Restoration Proposal from Nigel D. Johnson, Cohoes Design Glass Associates, Nov. 20, 2012

2. Restoration Proposal from Roberto Rosa of Serpentino Stained Glass, Inc, October 31, 2012

3. Condition Analysis by Julie L. Sloan, 2006.

4. Amherst's Stained Glass Treasures: The stories behind the opalescent art of La Farge and Tiffany at the Unitarian Universalist Society of Amherst.

Proposal for the Restoration

Of the

"Angel of the Lilies"

Stained Glass Window

By

Louis Comfort Tiffany

Nigel D. Johnson
Cohoes Design Glass Associates, Inc.
November 20, 2012

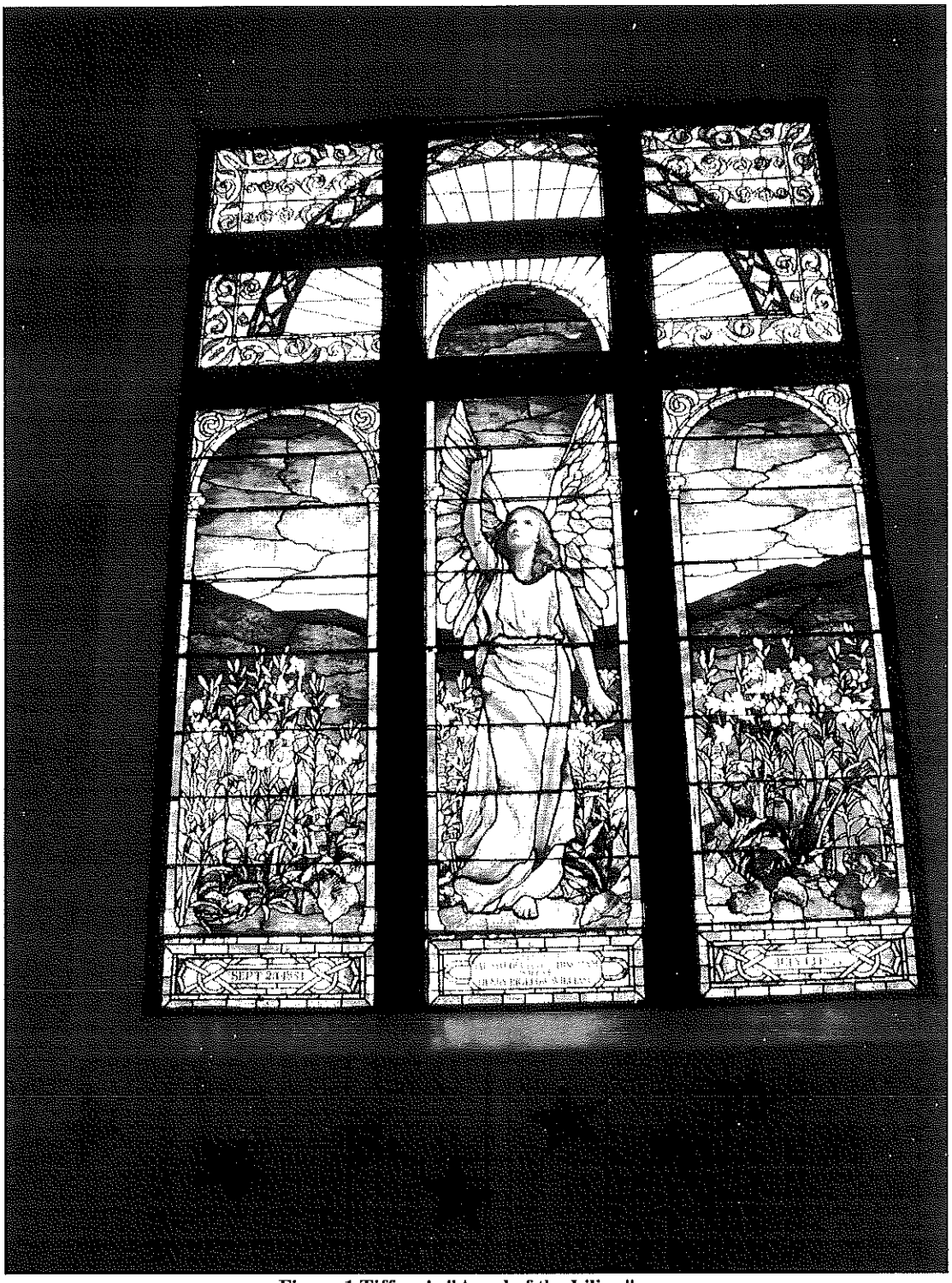

Figure 1 Tiffany's "Angel of the Lilies."

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Introduction

The art of stained glass is a thousand year old medium with well-established forms and styles that have been developed over the centuries and adorn many churches, cathedrals and public buildings throughout northern Europe, as well as museum collections in this country. By the time Messrs.' La Farge and Tiffany turned their attention from the painters easel to the glazing bench in the second half of the 19th century they began an odyssey that combined a new way of looking at stained glass with an inquisitive mind, and coupled with the wealth garnered from industrialization, (and it must be said with significant technical assistance from European immigrant craftspeople.) Before their now infamous falling out, together they were able to innovate and develop the medium into a completely new and unique form. The Unitarian meetinghouse is truly blessed in having the distinction of housing two important architectural stained glass windows by these preeminent major innovators to the art of stained glass in the United States.

Description

The "*Angel of the Lilies*" window is located in the front, west gabled wall of the meetinghouse, and it is approximately eight feet wide by thirteen feet tall. There are nine major window opening components in a three over three rectangular design format. The three main lower lancets are about eight feet tall and are dominated by the life size figure of a winged angel in the center lancet, with her right hand and gaze pointing heavenward. In the foreground of the flanking lancets there is an extensive field of lilies which is set against a landscape of hills and sky behind.

The main lower lancets are framed with slender columned vertical borders up to an arched top in the side lancets with decorative stylized floral infill to break the main rectilinear framing elements. While in the center lancet the landscape sky is carried up into the smaller section directly above with its own circular top breaking through and creating a visual upward movement. Overall there is a strong counterpoint between the main frame geometry and the floral curvilinear elements within.

The upper six transom sections have a large bordered semi-circular fan with radiating leads from the center, and beyond this are more stylized floral elements and borders to complete the design. The radiating fan design somewhat echoes the light from behind the hills in the lower lancets, and one is always left with thought of whether this represents dawn or dusk or indeed both. Reminding one of the old joke about a broken clock having the correct time at least twice a day!!

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More seriously, in religious imagery the lily is an often used symbol of purity and majesty, which is also denoted in the pure white of the angels costume. Beneath the three main lancets is the dedication; "*In the memory of Sarah Louis Frothingham, Wife of Henry Bigelow Williams,*" with the dates "*September 23, 1851 & July 13, 1871.*" The flesh areas of the figure are painted enamels, and there is some received belief that the face bears the likeness of the memorialized, Sarah.

As is typical of most windows by the Tiffany studios this window is largely comprised of dense streaky colored opalescent glass within a lead came matrix and in layers to create depth and modulated form. Folded drapery glass in the figures robe, and textured glass help to create the feathers in the angels wings and further help give a three dimensional naturalism to the clothed figure. There are saddle or support bars to the interior and a rudimentary exterior layer of polycarbonate or acrylic material as protection glazing.

As mentioned above the opalescent style was a uniquely American innovation and developed by easel painters who built picture windows in layers of opalescent glass in the same way that washes or layers of paint are applied to a support. As far as Tiffany windows as concerned the landscape window is often considered as the epitome of the Studios work in glass in the modern style, because, (flesh areas aside,) all the windows design elements are described in the materials - glass and lead without having to resort to the paint brush in the traditional style. While the content of the landscape has a natural organic philosophy without overburdening the window with mystical iconographic references, again in distinct contrast to its European antecedents.

History

The window was commissioned by Harvard graduate, Henry Bigelow Williams in dedication to the tragic loss of his beloved wife, Sarah Frothingham. She had succumbed to a fatal horse and carriage accident in 1871at the large family estate in Roxbury, MA, owned by Henry's father. In 1890 the completed window was installed in All Soul's Unitarian Church close to the family home in Roxbury, MA.

However, later after two congregations were merged the Tiffany window (along with La Farge's Triptych) was donated to the Amherst church in 1925 as a gift. In the interim they had been held in storage fate unknown, so it was serendipitous that these windows were reprieved from loss, and fate handed them on to their new owners in Amherst.

Condition

In general terms we know from long experience that windows of this age and style can present certain challenges when it comes to restoration. One of the first concerns the unique structure of these windows. Typically these windows are constructed in large heavy sections as the glass and lead in layers make them substantial objects. Over the years the effects of gravity take over, and the heavy sections become the victim of gravity. In layered windows this has the added disadvantage of the layers delaminating and causing further glass breakage. The main lower lancets of the Angel window are indeed three sections apiece stacked one upon another.

Another basic concern is the lead came itself, in this style of window the graphic of the lead came was sought to be minimized by using narrow and low profile lead came types. When they become fatigued and corroded through countless thermal cycles, they begin to break down more easily than the more substantial lead sizes as seen elsewhere.

During the 19th century this problem is further exacerbated by the material manufacture process because in lead ore refinement one finds silver deposits, and so the ore went through a de-silvering process to extract the valuable silver. This produced a fairly pure lead product, which contrary to the belief of the time , that over the decades this has proved not to the same longevity as an alloyed product. Pre-industrial lead refinement produced a less pure product which by accident has greater longevity. Modern lead came has trace elements added to the lead alloy to add longevity to the product.

A slightly more recent concern has arisen with the chemistry of some of the opalescent glass types. Glass is a non-crystalline structure, often described as a super cooled liquid, and engineers erroneously believe that glass slumps over time because it lacks a crystalline structure! However, opalescent glass also has non-vitreous additives, usually metal and other oxides which give the translucent opal effects, the down side to this is that it can further de-stabilize the structure of the glass, and it must be remembered that many of these glasses were experimental at the time of production.

Today it has been discovered that some of these glasses are breaking down often crazing that can develop into the "sugaring" of certain types of glass. There are many other concerns with this style of window to the knowledgeable that need to be carefully inspected and documented during the restoration process to ensure the best quality and most prudent approaches to the work.

In the particular case of this window, there are many stretched and corroded lead cames, and light leaks are clearly visible in the lower sections, as well as mismatched horizontal leads and saddle bars where the tie wires connecting the two have stretched and/or broken so that a double line is developing instead of the two lining up showing that the leaded glass sections are slipping under the combined weight of gravity and the fatigued lead matrix.

The upper sections were not easily viewed as they are way above eye level and somewhat recessed, but being of much smaller size it would not be unreasonable to conclude that they are in better condition as the gravitational effects as much smaller. However, the lead came is of the same vintage and so with be similarly fatigued to some extent by the freeze thaw cycle.

Finally it should also be remembered that the window sections have already been subjected to one round of trauma by its original removal from All Soul's, followed by several years in storage, and then eventual re-installation in the meetinghouse of the First Universalist Parish of Amherst.

Restoration Options

It has been noted for some time that this window is in need of restoration, and it follows that such an important window should receive the best quality and ethical care throughout. The main guiding tenants of all our conservation work is that all our work is fully documented, that we employ minimal intervention, and all our work is reversible.

We document all our work primarily with color digital RAW and jpeg images in transmitted and reflected light conditions, using a consistent light source. All images are labeled and show a scale for reference.

We also make full size archival rubbings on 100% rag vellum on which we note all pre-restoration existing conditions pertaining to the glass and lead. All our processes and alterations, if any are duly recorded. We also make a further original rubbing to use as a glazing sheet on which to rebuild the window sections.

The first thing is to organize and facilitate the removal of the window, and this requires us to secure the areas adjacent to the windows and set a temporary scaffold to the interior and exterior. The exterior glazing will be removed and the leaded glass sections released from the perimeter. The window sections will be covered in clear tape as a temporary measure to secure the sections in case they want to pull apart during the removal.

To the interior, and on a panel by panel basis, and from the top down of the larger lower lancets, the panels will also be taped, (with the exception of potentially fragile areas where paint exists,) and released at the perimeter and saddle bars removed. The top sections will be carefully removed and crated for safety. The same process is observed for the lower sections and the upper transom sections.

The areas adjacent to the windows will be protected and kept clean and vacuumed. Carefully dimensioned and photographed for reference will also be taken. All glazing grooves and/or rabbets will be fully cleaned, and sized plugs cut from exterior grade plywood cut and pre-painted to be installed in the openings. The existing exterior glazing will be reinstalled for additional protection.

All the stained glass sections will be carefully crated and transported to our studio where they will be fully documented before undergoing any restoration. At this time a final recommendation and determination can be made as to whether the restoration should be just confined to the lower three main lancets, or should also include the upper six transom panels also. After which the designated sections will be fully dismantled layer by layer (with further documentation as necessary per layer) and all the individual glass pieces will be cleaned with a mild detergent in an aqueous solution and fully rinsed and dried. The pieces will be trayed in order to ensure correct positioning.

All broken glass pieces will be edge glued where possible. All missing glass, or glass that is too broken and/or with voids, or previous replacement pieces may be fully or partially replaced on an individual basis with glass to match in color, texture, thickness and density. There is a caveat here that sometimes it may take one or two pieces together to match a required replacement. We will make our best judgment based on existing or available stocks from a variety of manufacturers. The painted areas will be carefully inspected and cleaned with great care using magnification to aid the process to ensure no paint loss during the cleaning process. All cold or fired paint will be documented on the rubbings and with photographs. Any sections not designated to be dismantled will be cleaned on both interior and exterior surfaces and given a new perimeter lead and tie wires.

Using the second rubbing of the original leading the panels will be re-built with new restoration grade lead came to match in profile and size with the original. All the lead cames will soldered on both sides at all adjacent lead joints, and fully waterproofed, cleaned, and burnished, layer by layer. The panels will be allowed to set up for a minimum of a week or two, before receiving their new tie wires and during this time all the structural elements (saddle bars etc.) will be fully scraped to bare metal and then primed and painted. The last process is the final documentation of after restoration with photographs and amended rubbings.

Finally the panels will be crated, transported and re-installed in essentially the reverse of their removal at a mutually agreeable scheduled time.

Protection Glazing

The protection of stained glass windows can be a thorny and contentious issue and so it is essential to establish sound parameters or objectives and then match the most appropriate system to the need.

There are several framing options and these can be matched to the glazing options and also importantly the particular site setting details. Sometimes the existing setting can be simply modified or amended, while in other cases a separate framing system is the best solution.

As far as glazing options there are several good options, although we usually recommend glass as opposed to polycarbonate or other plastic or petroleum based materials. We feel this is especially true on historic structures, but understandably polycarbonates do have certain strengths albeit over a limited period. In contrast glass can be laminated safety glass or even coated gas filled insulated units, and is relatively easily available, but it does require care during the installation. We look forward to working with you to establishing the required parameters for this project.

Restoration Budget Costs

The total cost to provide all labor and materials for the 100% restoration of the Tiffany "Angel of the Lilies" stained glass window would include: all removal, temporary plugging and re-installation of existing protection glazing system, crating and transportation of panels to studio. All scaffold access provided. Full in-studio services, full documentation with digital photos, annotated rubbings and written notes before, during and after the restoration. All dismantling, cleaning, glass and lead replacement, edge gluing, releading, soldering, waterproofing and cleaning, and burnishing of panels. All refinishing of structural elements, new tie wires. Re-installation in original location using the same installation methods, panels secured in place with perimeter tacks and setting tape, stops and/or putty beads, all saddle bars installed with secured and painted tie wires. All cleanup and removal of debris from site and the reinstallation of existing protection glazing.

Total cost	$114,750.00

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As mentioned in the narrative there are several optional system for upgrading the protection glazing that will provide enhanced visibility for the front elevation of the meetinghouse, protective qualities, and energy savings. A final determination can be made at a later date and with fuller knowledge of the existing setting details. Therefore a budget cost to provide an upgraded protection glazing system would be:

Budget cost	$10,000.00 - $12,000.00

Conclusion

The restoration of Tiffany's "Angel of the Lilies" window is a significant and important preservation project for a window that was born from the loss of a loved one and has survived redundancy and neglect and found a home at the meetinghouse in Amherst.

I hope the above narrative describes fully the significance of this window and the ethical and prudent approach for its restoration so that future generations can enjoy and appreciate, not only the significant American innovations in the art, but also the present generations commitment both to the past and to the future through prudent care and custodianship. We welcome the opportunity to assist the church in this regard.

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President

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October 31, 2012

Unitarian Universalist Church
121 North Pleasant Street
Amherst, MA 01003

Restoration Proposal for the "Resurrection Angel" Window Designed by the Tiffany Studio

Proposal

Scaffolding will be erected, on the interior and exterior of the Church, as necessary. Prior to removal, the window will be photographed in reflected and transmitted light using digital images in RAW and JPEG format. Each window sash will be removed for ease of handling and safer transportation. The openings will be covered with 3/8" plywood, painted on both sides. The windows will be carefully and properly transported to our studio. In the studio, each window section will be photographed again in reflected and transmitted light using digital images in RAW and JPEG format.

Every panel from the window, including the six transom panels, will be gently chiseled out of its sash, and placed on a workbench, over a 2" high-density, urethane foam sheet. This will ensure an even distribution of the weight of the sections and alleviate pressure from the multiple layers/plating. The sashes will be cleaned, sanded and deteriorated areas will be repaired with a wood epoxy. After restoration and repair, the wood sashes will be primed and painted (color to be selected by the Church).

Rubbings will be taken of each window section using 100% acid-free vellum paper and will include all sections and layers. The following information will be recorded on the rubbings: All lead and copper foil lines; Overall sizes of the panel; Where applicable, widths of the leads; Broken, missing, and cracked pieces of glass; Support bars and tie wire attachment points. The three bottom lancets will be completely dismantled and each piece of glass placed onto its respective locations on the rubbings.

Cleaning of the glass will be accomplished with a mild solution of Triton XLN-80 (a non-ionic detergent) and warm water. Utmost care will be used around all painted areas. Painted areas will be cleaned with cotton swabs and naphtha. All cracked glass will be repaired and conserved using Hxtal® Epoxy, Dow Corning® RTV 734 flowable silicone (conservation grade), or copper-foil. The method of glass conservation is dependent on the extent of the crack; location of the cracked glass and overall stability of the glass. All of the original glass will be reintroduced into the panels. Every panel in the Tiffany "Resurrection Angel" will be completely releaded or re-foiled. After releading, the panels will be soldered and waterproofed on both sides. The putty will be composed of whiting (calcium carbonate) and an organic oil medium. After the waterproofing has cured for approximately three weeks, the plates will be attached. The plates will be wrapped in new U-shaped lead, and soldered onto the panels in their respective location. The plated areas will then be waterproofed. New copper wires will be soldered to the original bar line location, and where needed, brass fins will be strategically soldered to the exterior of the panels in order to augment the structural system, and prevent the panels from deflecting again in the problematic areas. After conservation of all the lancets, digital photos in RAW and JPEG format will be taken of each section in the studio prior to delivery and installation. The panels will be reinstalled in their respective sashes, the copper wires twisted around their support bars, and the exterior perimeter sealed with neutral cure sealant. Scaffolding will be erected again on the interior and exterior of the Church, as needed, and the windows reinstalled in their respective openings.

New ¼" clear laminated glass, vented for air circulation, will be installed on the exterior of the "Resurrection Angel". The laminated glass will be properly secured and the perimeters sealed with a silicone sealant.

After installation, the windows will be photographed in transmitted and reflected light, using digital images in RAW and JPEG format. All digital photography will be copied onto archival CDs, placed in a binder, and returned along with the archival rubbings and digital photography, to the Church.

Cost for the complete re-leading of the "Resurrection Angel", including the six transom panels: $117,140.

Cost for the installation of a new vented protective glazing system for the entire window, using ¼" laminated glass: $6,380.

Total cost: 123,520 (One hundred twenty three thousand five hundred twenty dollars)
Cost includes all labor, insurance, scaffolding and materials.

Terms: 10% deposit to be returned with signed contract. Periodic invoices, as work progresses, due within 30 days of receipt. Final payment due within 30 days of completion.

For Serpentino Stained Glass, Inc.

Roberto Rosa

For Unitarian Universalist Church

_____

Duly authorized to sign
Please print name and title:

_____

Date of acceptance:_____

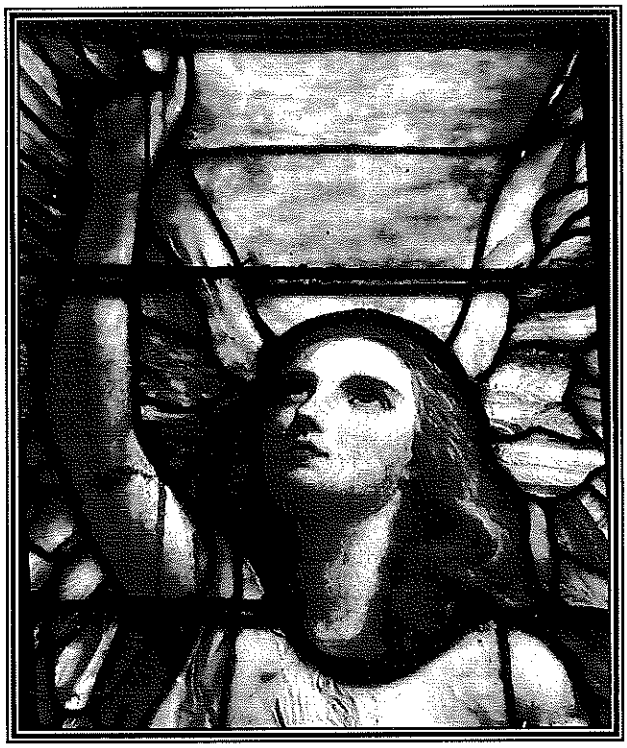
STAINED-GLASS WINDOW CONDITION ANALYSIS

Unitarian Universalist Church

Amherst, MA

August 16, 2006

PART I



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STAINED-GLASS WINDOW CONDITION ANALYSIS

Unitarian Universalist Church

Amherst, MA

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PART I

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STAINED-GLASS WINDOW CONDITION ANALYSIS

Unitarian Universalist Church

Amherst, MA

August 16, 2006

by Julie L. Sloan, Consultant

SUMMARY

The Condition Investigation was performed by the Consultant on May 2, 2006.

BASIC DESCRIPTION OF WINDOWS
Most of the windows in the Unitarian Universalist Society are ornamental, geometric-patterned cathedral glass that is probably contemporary with the construction of the building in 1893.

At the east and west ends of the building are large, important windows by John La Farge and Tiffany Studios, respectively. The La Farge was created in about 1889, and the Tiffany probably around the same time. Neither was created for this building, however: they were originally installed in All Souls' Church in Roxbury, MA. They were removed from that building in about 1925 and given to the church in Amherst. They were not restored at that time, and had only a few minor repairs.

SUMMARY OF CONDITIONS AND RECOMMENDATIONS
All of the windows are in very poor condition and should be restored as soon as possible. Window 16, in the secretary's office, is a hazard and should be removed immediately.

The Tiffany and La Farge windows should be carefully and fully restored. The other windows may be restored or replicated, or replaced with something new. We strongly recommend that the work on the Tiffany and La Farge windows be thoroughly specified (which we can provide), contracted to a conservator with experience in appropriate restoration of plated American opalescent windows, and overseen by someone like ourselves who can represent the church's interests in having the restoration done properly.

The estimated costs for restoration are:

La Farge Window	$176,500
Tiffany Window	$205,000
Ornamental Windows	$ 16,900

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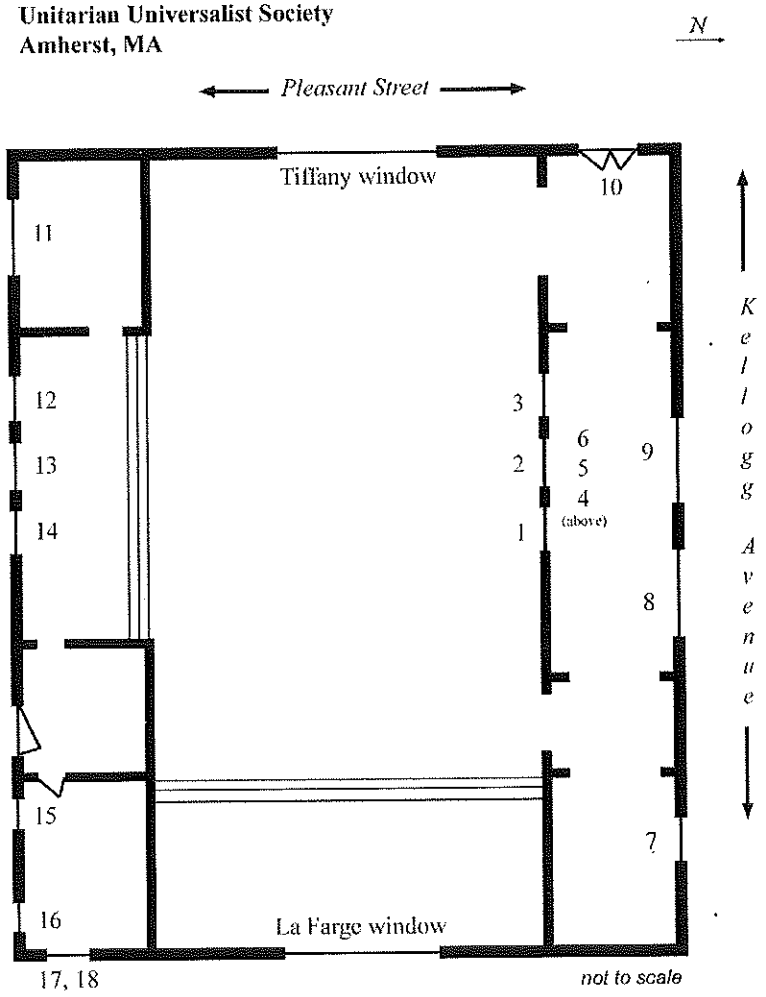
WINDOW NUMBERING DIAGRAM

Unitarian Universalist Society
Amherst, MA



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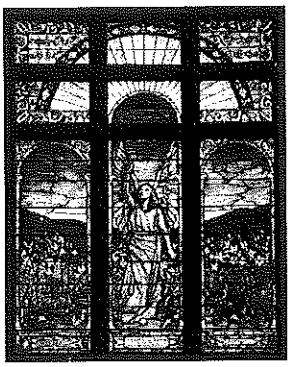
HISTORICAL BACKGROUND

TIFFANY STUDIOS, NEW YORK

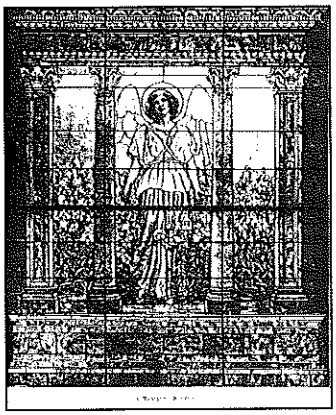


Louis Comfort Tiffany (1848-1933), scion of the jeweler and silver merchant Charles Lewis Tiffany, was one of the most prolific and popular decorative artists of his time. Although his work fell out of favor before his death, experiencing its nadir during the 1940's and '50s, its popularity has been revived in the last thirty years.

Although trained as a painter, Tiffany early in his career opted to become a decorator in 1879. Working with Candace Wheeler and Lockwood De Forest in various partnerships, ultimately under the name of Louis C. Tiffany and Associated Artists, he was favored with commissions to decorate such important interiors as the White House, New York's Seventh Regiment Armory, and the homes of Samuel Clemens and Hamilton Fish.

In 1881, however, Tiffany left Associated Artists to found Louis C. Tiffany & Co., primarily to work in glass, with which he had been experimenting since about 1878. Throughout the early 1880's, Tiffany dabbled in glass, creating windows to his own designs and for artists including Maitland Armstrong, Francis Millet, and Francis Lathrop.

In 1885, he reorganized his company into the Tiffany Glass Company, Inc. In 1890, he again changed the name to the Tiffany Glass & Decorating Company, which in turn became Tiffany Studios in 1900. He rose to great prominence as a glass designer, exhibiting several dozen windows at the World's Columbian Exposition in 1893. He also exhibited at the 1900 Paris Exposition Universelle and was represented in Paris by Art Nouveau impresario Siegfried Bing. In 1893, Tiffany opened his own glass furnaces at Corona, New York, and began to manufacture Favrile glass. In 1894, he trademarked the word "Favrile," defined in the Patent and Trademark Office as simply glass manufactured by Tiffany Studios. In the 1890s, he also began to produce copper-foiled lampshades.[1] The studio was very prolific, creating tens of thousands of windows around the country. It is important to remember, however that it was one of several dozen large studios in New York.



Tiffany retired from the firm in 1928. The studio continued in operation until 1936, three years after Tiffany's death.

The window in the Unitarian Universalist Society is quite typical of Tiffany's work of the late 1880s and early 1890s, prior to the employment of Frederick Wilson, who became the principal figural designer. A later version of this theme designed by Wilson was exhibited as part of the Columbian Chapel at the World's Columbian Exposition (right, in Tiffany Studios' 1893 brochure for their display at the Exposition; the

[1] Robert Koch, *Louis C. Tiffany: Rebel in Glass* (New York: Crown Publishers, 1964); Alastair Duncan, *Tiffany Windows* (New York: Simon & Schuster, 1980); idem, *Louis Comfort Tiffany* (New York: Harry N. Abrams, 1992; Hugh McKean, *The "Lost" Treasures of Louis Comfort Tiffany* (New York: Doubleday & Co., 1980).

angel was later removed from the window, which survives angel-less in the Charles Hosmer Morse Museum of American Art, Winter Park, FL) and was used in many windows.

JOHN LA FARGE (1835-1910), NEW YORK

John La Farge was one of America's most important and influential stained glass designers. His interest in stained glass was fostered in 1873 by a visit to Sir Edward Burne-Jones, and he was able to put it into practice beginning in 1875 with a commission from Harvard University for a window in Memorial Hall. That window was a failure, however, due to the lack of good glass. With a limited selection of colored glass, he tried layering, or plating, to achieve color effects, which, while it had potential in his opinion, produced a window of greater expense than Harvard's budget. By 1877, he had hit upon the idea of using opalescent glass in stained glass windows. This glass, previously made for tableware and objects to imitate fine porcelain, diffused the light much differently than colored pot-metal glass, throwing off additional colors that La Farge felt would provide him with greater freedom of expression. In early 1880, he was granted a patent for his plating process using opalescent glass, a year before Louis Comfort Tiffany would obtain a similar patent.

By the early 1880's, he was considered the foremost American stained glass designer and had obtained prestigious commissions from William H. Vanderbilt and his son, Cornelius II, additional contracts from Harvard University, windows for H. H. Richardson's Trinity Church (where he had painted murals in 1876-1877), the Union League Club, *Christ Visiting Nicodemus* in the Church of the Ascension, and many others.

His excellent reputation was sullied, however, with his arrest in 1885 for grand larceny, in connection with the demise of the La Farge Decorative Art Company, whose control had been in the hands of less than scrupulous businessmen. Although the charges were dismissed, La Farge's reputation was damaged for several years, a period during which Louis Comfort Tiffany filled the void with his stained glass windows. In this period, La Farge painted the "Ascension" mural for Stanford White in the Church of the Ascension, and "The Nativity" and "The Adoration" murals for the Church of the Incarnation. Many of his windows of this period are of inferior or marginal quality.

In 1889, he was awarded the French Medal of the Legion of Honor for his stained glass and by the mid-1890s, La Farge was in demand again. During this last period of his life he created some of his most complex and sophisticated window designs, including "Spring" and "Autumn" for William C. Whitney, the "Resurrection" for the First Congregational Church in Methuen, Massachusetts, "The Angel at the Healing Waters of Bethesda" for Mount Vernon Church, Boston, and the windows of Judson Memorial Church, New York.

The majority of his windows were fabricated by Thomas Wright and John Calvin of the Decorative Stained Glass Company, whose studio was located on Washington Square South. La Farge had trained Wright, who came to work with him around 1881, to execute his sketches using minute pieces of glass

and complex leading. La Farge supervised the construction of his windows, from the selection of glass to the painting, which was often carried out by Juliette Hanson. [2]

The window in the Unitarian Universalist Society is an example of the period between his arrest and his Medal of the Legion of Honor. At first glance, it appears to be very similar to *Christ Blessing* (also called *Christ in Majesty*) in Trinity Church, Boston, created in 1883 (right), because of the background of round turquoise jewels. Although the jewels are the same in both windows, the technique of glazing them is very different. The figure of Christ is very similar, lacking the halo in Trinity's window.

The figures of St. John and St. Paul are similar to ones he designed around this same period for Judson Memorial Church in New York (John, far left; Paul, left. The Judson windows were not fabricated until 1892-96). The figures are reversed in their positions at Judson. St. Paul holds different attributes and the model for St. John was different. There is speculation that the figure of the St. John at Amherst might have been modeled by the artist's mistress, Mary Lawrence Whitney. La Farge depicted her often in his windows, including the small oculus above the front door of Judson Memorial Church (below).

[2] Henry Adams, et al., *John La Farge* (Pittsburgh and New York: Carnegie Institute of Art and Abbeville Press, 1987); Julie L. Sloan and James L. Yarnall, "Art of an Opaline Mind: The Stained Glass of John La Farge," *American Art Journal*, vol. 24, 1992.

GENERAL INFORMATION ABOUT STAINED-GLASS WINDOWS

Since the Middle Ages, when the craft of stained glass was developed with the rise of Christianity for the decoration of churches and cathedrals, stained-glass windows have been made with essentially the same techniques and materials. A stained-glass window is made up of pieces of glass, usually but not always colored, held together with metal strips called cames, usually made of lead. Some or all of the glass is usually painted. The following is a description of these materials, the manufacture and deterioration processes of glass, lead, and windows, the techniques of fabricating stained-glass windows, and a summary of the restoration process. Its purpose is to familiarize you with the materials and processes of stained glass and its restoration, to enable you to fully understand the condition of your windows and what is required to restore them.

GLASS

All glass is made up of sand, lime, and soda, melted together. The colors of stained glass are imparted through the addition of various metallic oxides to the molten glass before it is formed into a sheet. These colors are permanent and do not alter with time, for the most part.

The glasses found in nineteenth- and early-twentieth-century windows are tougher than those used in the Middle Ages. The "glass disease" or corrosion commonly found in medieval windows is not a condition usually found in windows made after the seventeenth century. This is due to a change in the basic ingredients of glass. Early glass used potash instead of lime, which made a softer glass, much more susceptible to attack by water and air pollution. This sort of attack requires centuries to become evident, but should never affect nineteenth-century windows.

There are essentially three types of glass used in stained-glass windows, characterized predominantly by their method of manufacture. The first is **antique**, or hand-made glass. The term has nothing to do with the age of the glass. This glass is made in the traditional, medieval manner of blowing. Such glass is also sometimes referred to as **potmetal glass**, although strictly speaking all colored glass is potmetal glass. This means that the color is part of the glass, having been introduced into the molten glass in the form of metallic salts or oxides during manufacture. Antique glasses are colored and transparent. Antique glass is somewhat irregular, often having bubbles (called **seeds**) or striations (called **straw marks**) which enhance its sparkle. Most nineteenth-century European painted stained-glass windows are made of antique glass.

The most common technique for making antique glass is the **muff** or **cylinder** method. A bubble of molten glass is blown with a blow-pipe and elongated into an ovoid shape. The bottom of this long bubble is opened and the top is cut from the pipe, resulting in an open-ended cylinder of glass, called a **muff**. After cooling (**annealing**), the cylinder is cut lengthwise and the glass reheated to allow it to open out flat. Muff glass is fairly even in thickness throughout the sheet (as compared to crown glass); sheets today usually range from about 2' by 3' to 3' by 4' in size.

A second manufacturing method for antique glass, the **crown** method, was less widely used in the late nineteenth century, but John La Farge and some of his contemporaries, like Frederic Crowninshield and Louis Comfort Tiffany, made extensive use of it. Crown glass is made by blowing a round bubble of molten glass instead an oblong bubble. When the bottom of the bubble is opened, the pipe to which it is attached is spun rapidly, using centrifugal force to cause the glass to open and flatten out into a plate-

shaped sheet, called a **table**. Crowns rarely exceed several feet in diameter and are often much smaller. At the center, they are very thick. This center piece, the **bulls-eye**, is usually discarded, although it is not uncommon to see bulls-eyes in northern European domestic windows dating to the Renaissance and in some American nineteenth-century stained-glass windows. The outside edge of the crown is also quite thick and usually discarded. This method is not used as much as the muff method because of the amount of glass wasted. Smaller crowns only inches in diameter were used extensively in the late nineteenth and early twentieth centuries in domestic pattern-book windows and geometric windows. These small crowns are called **spun roundels** or **crown roundels**.

A variety of antique glass is **flashed** glass. It is characterized by its two layers of color. The base, or thicker layer, is usually a clear or pale tint, while the thinner, or flashed, layer, is usually a deep color such as red, blue, or black. Certain paler colors, such a rich purplish-pink, known as gold pink, are also flashed. The reason for making flashed glass is either that the color is too deep to transmit light in greater thicknesses, as might be the case with a deep ruby red or cobalt blue; or that the colorant is a very expensive, as in gold pink, which is actually colored with gold. Flashed glass is used to great effect in **acid-etching**, a process in which hydrofluoric acid is used to remove portions of the colored glass to reveal the clear or pale tinted glass beneath it. It is often used for inscriptions or to create atmospheric effects in opalescent windows. Flashed glass is made by dipping the blowpipe into the base color first, then the flashed color. When the bubble is blown, the two colors are fused together in layers.

The next type of glass is **cathedral**. This transparent colored glass is made by pouring molten glass on an iron tabletop and rolling it flat. Often the rollers are cut or grooved to impart a texture to the glass. The first machine-rolled glasses were made in the eighteenth century. These were rolled on one side only. In the 1870s, the **double-rolled** process was invented in England to texture both sides of the glass. Cathedral glasses are less brilliant than antique glasses, having a regular and somewhat dull surface texture. Different varieties of surface textures, such as ripples or ridges, are imparted by rollers during the manufacturing process. The decorative windows in the church of made of this type of glass

The third type of glass is **opalescent**. This glass is characterized by a milky opacity. Its colors are usually more pastel than vibrant. It is usually machine-rolled (and is therefore also a cathedral glass), but is sometimes further manipulated by hand. A sheet may incorporate more than one color. Opalescent glass is available in many of the same textures as cathedral glass, but is also found as a variety called **drapery** glass, which is formed by hand into thick, undulating folds imitative of drapery. Other types of opalescent are hand-cast, including **mottled** or **catspaw**.

Opalescent glass was developed in the late 1870s. Although John La Farge is often credited with the "invention" or "discovery" of opalescent glass, his major technical contribution was his patented use of such glass in layers for windows starting in 1879, thereby causing a revolution in stained glass design. Such milky glass had been used for glass vessels for many years. La Farge, however, was the first to incorporate this glass into windows on a large scale, and the first to commission glass manufacturers to produce it in sheets for stained glass. Louis Comfort Tiffany also commissioned opalescent glass from glassmakers, and later opened his own glass furnace to produce the glass for his own windows.

JEWELS

These three-dimensional pieces of glass were used both for their textural effect, visible at night when no light illumines the window, and for their diffusion of light which adds visual interest to the window during the day.

Many jewels were made by pressing molten glass into steel molds. The molds were cabochon (smooth) or faceted, and were available in many sizes and shapes. Hemispherical cabochons make up the background of the La Farge window.

PAINT

In addition to the basic color of the glass, most historic stained-glass windows are painted with fired vitreous paint before they are assembled into windows. This paint, used to decorate or enhance stained-glass windows, is made up of metallic oxides and ground glass. Paint sometimes imparts additional color, but usually is a dark opaque tone. Details such as facial features, drapery patterns, and inscriptions are usually painted. Vitreous paint has been used to delineate details in stained-glass windows since the early Middle Ages.

The vitreous (glassy) powder is mixed in a liquid medium for application to the glass and then fired in a kiln at temperatures between 800° and 1300° F. During firing, the glass paint melts and fuses with the surface of the glass, making it very durable.

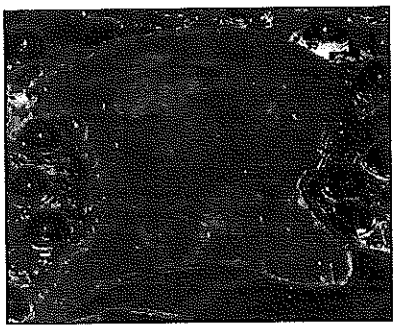
There are several kinds of glass paint. **Grisaille** (pronounced "gree-si'" to rhyme with "brie sky," based on the ancient French term for "grey") or **glass-stainer's colors** are the oldest type of paint. They are dark, opaque browns, blacks, iron reds, and dull greens, usually applied to the interior surface of the glass. They are composed largely of iron and other metallic oxides with a small amount of flux (ground soft glass) to aid in their melting. These paints are used for **trace** lines, the opaque outlines created with thin brush, and for **mattes** (also spelled "matts"), the shadows created by thin washes of paint that are stippled or blended to suggest form and shape.

A second type of paint is **silver stain**. This is a transparent yellow color that can range in tone from pale lemon yellow to deep orange. It sometimes has an iridescent metallic surface appearance in reflected light. The name comes from the material used to derive the color: silver salts are applied to the exterior of the glass, and fired at very high temperatures. It was discovered for use in stained glass in the early fourteenth century. It is found in many types of windows, especially Gothic Revival windows. It is the most durable of glass paints.

The third type of glass paint is **enamel**. Enamels are colored paints made of ground colored glass. They tend to be paler in tone than colored glass, but can be intensely colored. In surface appearance, they are shiny, and are usually found on the interior surface of the glass. They tend to be fragile, because they are fired at low temperatures and sometimes do not fully fuse to the glass surface. Enamels were invented in the sixteenth century and are used to this day. They are found largely on heraldic panels and in opalescent figural windows. All three types of paint may be present in the Tiffany window; grisaille and enamels were used in the La Farge window.

Often an artist other than the craftsman or glazier was the painter; sometimes the window's designer may have been the painter, but this was not always the case. The paints are mixed with various liquid media and other substances to aid in the application of the paint to the glass. These different media serve several purposes. In some cases, they handle differently, allowing the artist to obtain different effects. For example, an oil medium might be used for tracing very thin, fine lines, either with a tiny brush or with a steel pen. Alcohol or turpentine is often used for various degrees of softness in a matte. A medium containing gum arabic or sugar is usually used for ordinary tracing. Another reason for using several different media is to allow the paint to be layered without firing between applications. For example,

an alcohol matte can be applied over a water-and-gum trace line without fear of dissolving the trace line and washing it away. If a water matte was used over a water trace, the trace would have to be fired first.

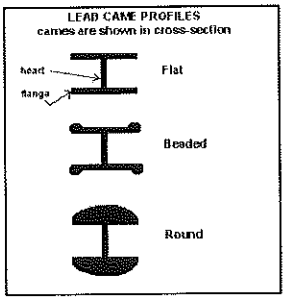


A fourth type of paint found in stained-glass windows is not technically a glass paint. It is referred to as **cold paint** because it is not fired, as glass paints are. Cold paint can be any type of unfired paint, including artists' oils, housepaints, or glass paint that simply has not been fired. While old glass-maker's wisdom has it that "good" windows never employed cold paint, in fact many windows made in the nineteenth century did in fact use cold paint extensively. The faces of St. John and St. Paul in the La Farge window have extensive cold painting, which can be seen in reflected light. In St. Paul (left), the yellowish and greenish paints are cold paints, probably artists' oils, which he typically used.

Much glass paint from the late nineteenth and early twentieth centuries is not as durable as it should be. This may be due to any one of a number of factors, ranging from inadequate heat or time in firing to a poor recipe or mixture of the color. Unfortunately, there are very few usable methods to conserve fragile glass paint, although it may be recreated.

CAMES

After the glass is cut, painted, and fired, it is held together with I- or H-shaped metal strips called **cames**. The pieces of glass fit between the **flanges**, or parallel legs, of the came. The center of the came is called the **heart**. The came is formed around the shape of the glass and joined at the ends by soldering.



Cames were traditionally made of lead, and most still are. Lead is used because of its malleability. Lead came comes in three basic profiles: flat, beaded flat, and round. Some late nineteenth century windows may have cames made of zinc or brass.

Traditionally, stained-glass windows are assembled in one contiguous layer. Occasionally a piece of glass will have another piece layered or **plated** over it to create a particular color effect, but this was not widely used until John La Farge patented it in 1880. In opalescent windows by La Farge and Tiffany, two, three, even up to five or six layers of glass are plated together. Sometimes they placed two pieces of glass together and wrapped both in one came. Equally often, a piece of glass would be wrapped in its own came and soldered on top of other pieces wrapped in lead came. This was done to achieve both coloristic and atmospheric or perspectival effects. In many plated windows, and in some unplated windows, made in America, the lead came is **floated**, or coated with solder.

Lead is mined for the silver ore with which it occurs naturally. It has always been the by-product of the smelting of that silver, and in the Middle Ages, the lead left after the silver was removed still contained up to 4% silver. In the middle of the nineteenth century, the smelting process was improved to remove that remaining silver. As a result, the lead available to stained glass craftspeople after 1850 was virtually 100% pure lead. While this sounds like a benefit, a century later we have discovered that it is not. Pure lead came has a life-span of only about one century, while leads from the Middle Ages sometimes lasted

several centuries. Research into this phenomenon has deduced that without the silver (or copper, which performs the same way and is less expensive), lead **fatigues** much more quickly. In lead came in stained-glass windows, this fatigue is caused by expansion and is noticeable as cracks or embrittlement. This cannot be reversed or corrected. As a result, most windows which are a century old require extensive releading. Typically the lead used in Europe in the late nineteenth century is longer lived than that used in the United States. As a result of this, windows assembled in Europe are often in better condition than those made in the U.S. Lead specified in restorations today should contain trace levels of certain metals other than lead to forestall having to relead the windows again in a hundred years.

It must be understood that while lead cames may look fine in a window, and in fact may survive another generation if left alone, moving a window for any reason at all stresses that came and can rapidly accelerate its deterioration. This is because the heart of the came, which is not visible in a condition inspection, is eaten away by glazing putty and water. Left alone, the window maintains a status quo because the heart is not stressed. When moved, however, the window flexes; such movement cannot be avoided. This flexure can cause the heart to separate and lead to the window's collapse. Therefore, windows from the late nineteenth and early twentieth century should never be moved without care and understanding that such moving may drastically reduce the time left before they require restoration.

ASSEMBLY

To make a leaded glass window, first a drawing is done of the proposed design. Drawings are rarely done full-size, they are small scale sketches. These must then be enlarged to full-size in order to make the pattern, called a **cartoon**. The full-sized design is copied onto paper twice. The original cartoon is kept for reference. One duplicate is cut up for patterns; and the other is placed on the glazing table (called the **bench**) on top of which the window is assembled.

In order to cut the patterns, a three-bladed shear is used. This removes a narrow strip of paper from between the pieces to leave room for the heart of the came. The paper patterns may be tacked to the cartoon, or separated by color for cutting, depending on the nature of the design.

Colored glass is selected by the artist or craftsman piece by piece. After a piece has been chosen, the paper pattern is placed on top of the glass. Using a steel wheel glass cutter, the craftsman scores the glass around the pattern piece, following its edges exactly. The glass is separated by pulling away from the score. Burrs, slanted edges, or inaccurate cuts must be adjusted in order for the panel to fit together. This is done by **grozing** or chipping the edge with grozing pliers or a grozing iron, a steel tool with a notch cut in the side. Many modern glass cutters have grozing notches on their sides. By levering the glass in the notch of the grozing iron or in the mouth of grozing pliers, tiny chips are removed and the shape of the piece is minutely changed.

The pieces are then **waxed up** for painting. On a large sheet of plate glass, the lead line of the window is traced in black paint from the reference drawing. Each piece of cut glass is then attached to this plate-glass easel in its correct position, using a beeswax mixture to adhere it in place. The easel is then placed vertically in front of a light source (a window or light box) for painting. Alternatively, painting may be done horizontally on a light table, in which case there is no need to easel the pieces on the plate glass.

After application of the paint, the pieces of glass are removed from the easel and placed on a kiln tray, usually on a bed of whiting. The tray is then placed in a kiln for firing. Firing melts the flux of the paint and softens the surface of the glass, bonding the paint to the glass. In the late-nineteenth and early-

twentieth centuries, kilns were fired with either gas or electricity; today, most kilns are electric. Prior to the discovery of gas and electricity, kilns were heated with wood fires.

When all the decorative processes on the individual pieces of glass are completed, the panel is ready for glazing. Placing the glazing diagram on the bench, strips of wooden lath are nailed to the bench to form a guide for the corner of the panel. The cames for this corner are cut and placed against the lath, and glazing has begun. Working from one corner across the window, the glass is placed in the came, then another piece of came is cut and placed, then glass, and so on. The glazing guide beneath the panel ensures that the pieces are placed correctly and that the size of the panel is kept accurate. In order to keep the assembly, which is not yet soldered, from coming apart, large nails are tapped into the bench at the edges of each newly placed piece of glass. When the opposite side is reached and all the glass and came are in place, all the nails are removed and laths are nailed in place on the final two sides of the panel. The panel is ready to be **soldered**.

All the joints of the panel must be soldered on both sides. Before soldering, they must be **fluxed**. Flux cleans the came and assists in the distribution of heat to allow the solder to flow smoothly. There are a variety of fluxes; in the Middle Ages, tallow was used. Today, zinc chloride, oleic acid, stearic acid, and other materials are used. Flux is wiped on every joint, and the heated soldering iron is touched to the solder and the joint to melt the solder into the joint and connect the cames. When the upper side of the panel is completely soldered, the laths are removed and the panel must be carefully turned over to solder the other side. After soldering, the panel is cleaned to remove all traces of flux.

WATERPROOFING

After soldering the stained glass panel, a **waterproofing compound** is forced beneath the flanges of the came to seal and weatherproof the window. Traditionally, this was a putty made of boiled linseed oil, whiting, red or white lead, kerosene, and lampblack. It is usually mixed to a fairly soupy consistency and brushed under the flanges, but sometimes it is a thicker, clay-like mixture that is thumbed into the cames.

Linseed-oil-and-whiting waterproofing has a lifespan of between about forty and one hundred years. Its durability is dependent upon its formulation and the conditions under which it has weathered. In restoration in America today, linseed-oil-and-whiting putty is still the best waterproofing material, far outlasting any modern synthetic putty.

More modern recipes for glazing putty often include a portion of Portland cement. This is **not** a desirable additive, because it sets too hard. Windows puttied with Portland cement cannot move with lateral pressure, but stained glass windows need to move slightly, to flex with wind pressure and to expand and contract with thermal variations. Often windows bow shortly after installation; when Portland putty sets, these bows become permanent. Windows puttied with Portland cement cannot be disassembled for repair or restoration. Should glass break or the window otherwise deteriorate, restoration is impossible.

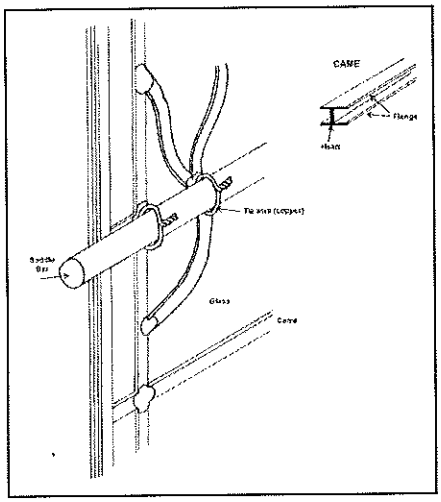
SUPPORT BARS

Stained-glass windows generally require **support bars** to assist in keeping them in a flat vertical position. These bars are necessary, even though they can interfere with the design. Stained glass designers who understood the necessity of bars worked them into the design. This can be seen in medieval windows, where the bars outline medallions.

There are several kinds of support bars. Generally they are all made of steel or iron.

T-bars are steel or iron bars shaped like a T set on its side. These bars support a stained glass panel at its lower edge. Often there are one or more T-bars in a window, ensuring that the entire weight of the window is not resting on the bottom border or the sill, but is distributed more evenly to the jambs.

Windows that are set without T-bars between sections have **stacked** or **meeting joints** between sections. This means that all sections rest on the sill, supported by the section below it. A saddle bar should be installed at the meeting joint, instead of a T-bar.



Saddle bars are round, square, oval or flat bars which span the surface of a panel. They should be set into the frame or sash and fastened to the window. A common design for round saddle bars features a flattened, or spooned, end. This flattened end may be set into the groove or rabbet and held only by putty and the pressure of the window (usually seen in stone frames only); or they may be pierced and screwed to the frame (usually found only in wood frames).

The most ancient and traditional method of fastening a saddle bar to a panel is by use of **tie wires**. Tie wires are copper wires soldered to the stained glass panel and twisted around the saddle bar after installation to hold the panel against the bar. Beginning in the late nineteenth century, flat bars have been used by soldering the narrow edge of the bar directly to the panel instead of using tie wires.

Round saddle bars are sometimes replaced with flat bars soldered to the window instead of tied. This technique was especially popular in the 1970s. It is often not an adequate solution to settling and can damage the lead came of a window if done poorly.

VENTILATORS

Many stained-glass windows were originally installed with operable ventilators. Usually these are located at the bottom of the window where they are easily reached to operate, but it is not unusual to find vents in upper locations, even in clerestory windows. The most common form of opening is a center-pivot hopper hinge, in which the upper half of the panel drops inward and the lower half raises outward. Sometimes top or bottom hinges are present, and more rarely, the panels are casements, with hinges at the sides.

Traditionally, vent frames were of steel or occasionally of bronze. Steel frames require regular painting and oiling to remain operable. When this does not occur, they can rust, causing binding and sometimes freezing of the hinge, making them difficult or impossible to open and close. (Bronze frames do not require this kind of maintenance.) Settlement in the window frame may force vent frames out of alignment, which also affects their ease of operability. Even when frames operate smoothly, it is common for the vents to move rapidly, falling open or slamming shut.

Because of the movement of sashes, vent panels are usually the most damaged area of a stained-glass window. Bowing is very common, because the panels are in an almost horizontal position for much of

the time. Breakage in the vent and in the panels around the vent is also common because of the impact and force of closing.

A popular but not preservation-minded approach to the repair of vent frames is to replace them with aluminum frames. The most popular aluminum frames provided by stained glass firms are made by J. Sussman of Queens, NY and CAFF Company (Custom Aluminum Frame Fabricators) of Pittsburgh. They are usually provided with a bronze anodized finish. Their installation causes both reparable and irreparable damage to the window however. Aluminum is not as strong as steel, and therefore in order to provide the same amount of support, aluminum frames must be much larger than steel frames in section. In order to fit the old stained glass panel into aluminum sashes, it is necessary to remove about 1" on three or sometimes all four sides of the panel. This loss of historic window fabric is irreparable. Typically, this removal is done by cutting the panel without removing the glass from the lead cames. This often results in breakage of glass, because it is impossible to obtain a good score with a glass cutter when the edges of the pieces are covered with came. Often the installers do not take the design of the window into account when making these alterations, removing glass from one or two sides only, which results in poor alignment of the pattern when the panel is reinstalled. We categorically do not recommend replacement of steel vents with aluminum, but if aluminum vents have already been installed, it is usually not satisfactory to remove them because of the loss of original glass.

EXTERIOR PROTECTIVE GLAZING

EXISTING PROTECTIVE GLAZING

All of the windows except 4-6 and 11 are covered on the exterior with various types of protective glazing. The Tiffany, La Farge, and windows 12-14 have plastic glazing screwed into the wood frames. Windows 7-9 and 15-18 have aluminum double-hung storm windows, glazed with glass. All of this has been installed within the last 30 years or so. Window 11 has plastic installed on the interior. None of the protective glazing is vented.

The La Farge window also has a layer of glass between the stained glass and the protective glazing. It is divided into sections that correspond with the sections of the window. The lights are held by zinc channel.

THE PURPOSE OF PROTECTIVE GLAZING

The issue of protective glazing is a sticky one. Many windows do not require it. If installed improperly, it can cause more damage faster than any other factor except vandalism. It has practically no value as an energy conservation measure in a historic building.

Generally we do not recommend its use except 1) if the building is in area where vandalism, theft, or accidental breakage from impact (such as next to a playground) poses a real and significant threat; or 2) if the windows contain fragile glass or glass paint which is otherwise exposed to the elements; or 3) if restoration procedures or materials have been used which are not weather-stable (such as epoxies); or 4) if the market value of the windows is extraordinarily high and/or the cost of restoration would be very high in the event of damage.

VENTILATION

By far the most critical aspect of protective glazing is its ventilation, which must allow a complete and continuous exchange of air between the stained glass and the protective glass. If this exchange does not happen, moisture will collect between the stained glass and the protective glass. It is impossible to completely seal that space because a stained-glass window will always leak air. This trapped moisture will condense on the lead and very rapidly corrode the glass, glass painting, glazing compound, and lead. It will also cause extensive damage to the framing of the window and often seeps to the interior of the building, causing damage to plaster and finishes. This will happen more quickly in a closed environment than in an open one, because the water is always present. Therefore, unventilated protective glazing will actually damage a stained-glass window faster than any natural aging could.

One of the principle questions surrounding the design of protective glazing concerns whether to the vent to the inside of the building or to the outside. There is no one simple answer; it depends on many conditions, including the framing materials, the type and condition of the stained glass, the construction of the building, and the orientation of the windows to the sun. Generally speaking, it is usually less expensive to vent to the exterior; and it is usually impossible to vent to the interior in stone settings or if the windows are not being removed.

GENERAL RECOMMENDATIONS

Glazing Material

Plastics

We do not recommend the use of a plastic material, such as polycarbonate (General Electric's Lexan®) or acrylic (Plexiglas® or Lucite®). Polycarbonate, the toughest available plastic, is sold as being unbreakable, but the manufacturer guarantees this for only 2 years. Tests and experience have shown that polycarbonate becomes very brittle after five to ten years of exposure, and by that time can be as easily broken as glass. In addition, despite manufacturer's claims to the contrary, polycarbonates change in appearance after several years of exposure. They can become opaque, scratched, or yellowed.

Acrylics are more brittle than polycarbonates, although cell-cast acrylic is stronger than other forms. Acrylic tends to yellow and scratch from wind abrasion more rapidly than polycarbonates.

The rate of expansion of plastics is very high, and if not set properly – i.e., if set by drilling through the plastic to fasten it – shear tears, cracks, and other degradation usually occurs as a result of expansion stress. In addition, the warping and bowing of plastic gives the building an unattractive appearance and contributes to its degradation over time.

A better installation requires the plastic sheet to be set in wide frames, usually aluminum. These frame sections, which are sold specifically for the storm glazing of stained glass windows, are usually 2" to 3" wide. Unfortunately, it is extremely rare that such framing can be made to coordinate or harmonize with the exterior appearance of an historic building.

As a result of these various degradation modes, plastics typically require replacement within ten years.

Finally, the cost of polycarbonate averages four times the cost of glass. Compounding this cost every ten years makes polycarbonate an extraordinarily expensive, as well as unattractive, alternative.

Glass

We recommend the use of glass for protective glazing. In most buildings, we recommend ordinary laminated glass, at least 3/8" thick. Although the glass itself can be broken on impact, it is far more difficult to penetrate the polyvinyl inner layer, which keeps the stained glass intact. If there is a very high risk of vandalism, burglar-resistant laminated glass is also available.

Due to the difficulty of cutting laminated glass into complex shapes required in tracery, ordinary 1/4" plate glass is generally sufficient in these areas, which are usually quite high and therefore protected from ordinary vandalism.

In areas where accidental breakage, such as falling tree limbs, may be a more realistic concern, tempered glass may be suitable. The process of heat-strengthening creates a glass that is typically two to four times as strong as ordinary plate glass. Tempered glass cannot be used in windows with complex tracery, nor can it be used in settings that require drilling of the glass for fastening.

Framing and Setting

Designing a framing and setting system is often the more difficult task. In general, framing should be visually subordinate. It should not obscure tracery and framing on the exterior, or cause shadows on the stained glass from the interior. It should place the protective glazing not less than 1" away from the

stained glass. Mullions, if required, should align with mullions or major divisions in the stained glass windows so that they do not cast shadows on the stained glass visible from the interior.

Whatever kind of framing is designed, the space between the stained glass and the protective glass must be vented to allow full circulation of air. Vent holes at the top and bottom of each independent light is required. The jambs should be sealed, which will create a convection current and allow air movement.

Venting to the interior is possible. Interior venting is the best setting for the stained glass, since it surrounds it with interior air, keeping the temperature and humidity equal on both sides of the window. This tends to prevent the formation of condensation on the stained glass itself. On very cold days, condensation may form, but it will be on the protective glazing.

If the sanctuary is to be air-conditioned, ventilation should be to the interior to prevent energy loss. In this case, the protective glazing can be made of an insulated unit.

SPECIFIC RECOMMENDATIONS FOR PROTECTIVE GLAZING

We recommend that laminated glass, with adequate ventilation of the space between it and the stained glass to permit free air circulation, be installed as protective glazing on the Tiffany and La Farge windows, because they are valuable and would be expensive to repair. The La Farge is also in a vulnerable location on the rear of the building.

Once the other windows are restored, there is no reason to put protective glazing on them. The frame construction of the church building is such that more heat escapes from the walls and roof than from the windows, so the protective glazing is probably doing little for energy conservation.

STAINED GLASS RESTORATION

POOR REPAIR TECHNIQUES

Many windows have been restored or repaired in the past. Stained-glass windows are, after all, made of glass, which breaks, and lead, which, being soft, sags. Windows have been periodically releaded since the Middle Ages, although in America, where we have few windows of that age, fewer windows have been releaded.

Many of the restoration techniques used in the past are no longer considered state-of-the-art. This includes, in some cases, replacement of broken glass. There are circumstances in which broken or deteriorated glass must be replaced; however, glass that is simply broken in two or three pieces can almost always be rejoined. Another outdated repair technique is the use of **strap leads, flanges**, or **dutchmen**. These are whole lead cames inserted into a crack, or the flange of a came applied over the top of the crack. When a whole came is inserted in a crack, usually glass must be removed by grozing (chipping the edges to remove material). This type of repair destroys original glass, making it very problematic to restore. Applying a came over the top of a crack is far less destructive, although it is unsightly. It can cause deterioration, however, especially if placed over paint.

A more recent repair technique to deal with broken glass in a window is to squeeze a bead of sealant or caulk over the crack. Usually this sealant is whatever the hardware store has in stock -- bathtub caulk is not uncommon, nor is black or brown sealant. It is also not uncommon to see sealant used to mend broken solder joints, or to take the place of came, or even bridging a gap between the glass and came. This is not considered an acceptable restoration procedure, and furthermore has no structural value.

Replacing broken glass without removing the window so that it can be worked on in a horizontal position often causes more damage. Pieces around the broken area can break, and usually the came is very badly damaged. Fatigued lead cannot withstand the bending required to remove and reinsert a piece, and it can crack or break off. Often, the repairman does flatten the bent cames down evenly, leaving the cames looking ruffled and ragged. Mismatching the missing glass is another common problem.

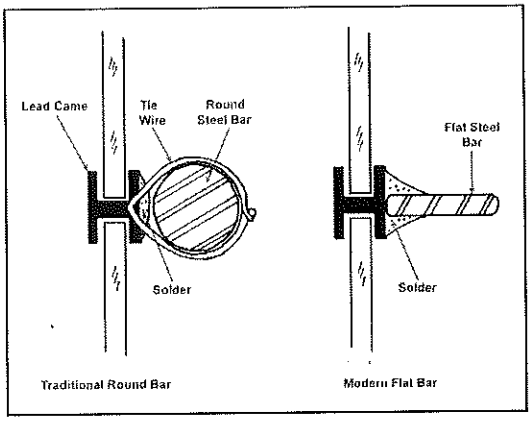
Resoldering old came is another repair procedure that is often inadequate. Old lead is often corroded, sometimes deeply into the metal of the flange or through the heart. It is impossible to solder to corroded lead, because the corrosion is no longer metallic. Often, in an attempt to melt what cannot be melted, too much heat is applied, melting adjacent came or even cracking glass. In addition, this type of repair is usually carried out without removing the window from the opening. When heated, solder becomes liquid and flows with gravity, meaning that it will drip, making it difficult to get enough solder into the joint.

Another method of improving the appearance of corroded lead is to brush the surface with a wire brush. This removes the surface corrosion (both the "good" grey patina and the "bad" white deposits) and makes the lead shiny. It is often done to make the owner think the window has been improved or cleaned. In reality, wire brushing is a very harsh technique that removes material from the came, weakening it slightly. More seriously, it can scratch glass and glass paint, even removing paint or glass chips.

The alteration of saddle bars is a very common repair problem. Round saddle bars that were tied to the window with wires are often replaced with flat bars soldered to the window. There are a number of

common problems that arise from this practice. As discussed above, it is very difficult to effectively solder to deteriorated came. Often the bars used are not tinned or galvanized, which causes them to rust and can stain the window. Most important, these flat bars often do not tab into the window frame or sash, meaning that the window is supporting them, instead of them supporting the window.

Alternatively, saddle bars (both round and flat) are sometimes readhered to the window using sealant. This provides no strength to the window, since even structural sealant does not transfer the window's weight to the bars.



One of the most destructive alterations commonly practiced on old stained-glass windows is the replacement of steel ventilator frames and sash with aluminum. Aluminum is not as strong as steel and therefore requires a large profile to provide the same strength. In order to make room for this larger frame section, stained glass must be removed from the perimeters of the panels. Perimeter glass in vent panels often includes dedications and signatures. This historic glass is usually irreplaceable.

Another common technique is to reputty or rewaterproof windows. This is difficult to do effectively. The most effective way is to fully remove all old glazing putty, which can only be accomplished when the window is on a glazing bench, not in its opening. The old putty may be friable, but often is very hard and may require soaking or solvents to aid in its removal; these cannot be employed when the window is vertical. When rewaterproofing is done on site, usually it is done over the old putty, and so is of questionable value, since it cannot fully adhere to the lead beneath the flange. The effect is similar to applying new house paint over old peeling paint without scraping first. Also, it is usually not cleaned up well, leaving a bevel of putty around the perimeter of every piece of glass, which obscures the light and can cause deterioration of the glass paint. It can also leave a film of oil on the glass and lead, which also contribute to deterioration of the paint and lead and attract dirt.

RESTORATION PHILOSOPHY

There are numerous guidelines for the conservation of artworks, architecture, and cultural artifacts that this firm espouses and which are reflected in our recommendations. These include those established by the United States Secretary of the Interior's Standards for Rehabilitation and Restoration of National Historic Landmarks; the American Institute for Conservation of Art's Guidelines and Standards for Restoration; and local landmarks laws.[3] These guidelines include the following points:

1) Restoration and maintenance will retain as much original material as possible.

[3] There are also several documents of standards for stained glass restoration published by the Stained Glass Association of America, the Census of Stained Glass in America, and the Association for Preservation Technology. While the intent of these documents is laudable, we do not recommend them as standards because they are out of date in both materials and techniques. In addition, those produced by the Stained Glass Association were written by contractors and so favor their needs, rather than those of the windows and their owners.

2) Where such restoration or maintenance is not possible, the original material will be recreated exactly in form, shape, color, size, style, and ingredients *except* where such recreation would create the same deterioration situation, in which case the outward appearance of the material will not be changed, but its composition or configuration may be. An example of such a change is the alloy used for lead came.
3) All restoration will be reversible wherever possible (replacement of lead came is not reversible). Where restoration is not reversible, samples of all replaced materials will be kept.
4) All restoration will be accurately and thoroughly recorded.
5) The longevity of all restoration materials and procedures is critical; every effort will be made to ensure that further restoration or repair will not be required for a century.
6) The restorer is the servant of the original artist; the hand of the restorer will not be visible.

It is critical that any contractor asked to work on these windows understand and follow these guidelines. Many stained glass studios fail to understand them, however, and adhere to "traditional" methods and attitudes. Sadly, many of these are damaging to windows, since they destroy original material which can never be reclaimed.

Typical and common procedures that are **not** considered appropriate restoration technique include the following:

1) Replacement of broken glass.
2) Replacement of tied saddle bars with flat, soldered bars.
3) Replacement of any structural element (sash, frame, or bars) with a different material; for example, replacement of steel vent frames or T-bars with aluminum.
4) Flattening of bulges in place.
5) Use of silicone to repair cracks in place or caulk the window in place.
6) Attachment of bars or wires in place.
7) Use of lead came, lead flange, lead foil, or sealant to cover or rejoin a crack (such repairs are often called dutchmen, strap leads, or flanges).
8) Application of polycarbonate (Lexan ®) or other material for protective glazing without restoration of the stained glass or without ventilation.

We strongly advise that if stained glass contractors are interviewed for work on your windows, you ask them very specifically if they use any of these procedures. If they do, be forewarned that the contractor is not familiar with appropriate conservation technique.

APPROPRIATE TECHNIQUES OF RESTORATION

The basic techniques of stained glass restoration may involve releading, cleaning, edge-joining of broken glass, replacement of missing original glass, and re-waterproofing. In order to perform restoration adequately, without damaging the windows further, it is necessary to remove the windows to the stained glass studio. Restoration usually requires at least several months, and may require up to a year or more if the window is large or complex.

In the process of releading (which is sometimes called reglazing), old, fatigued came is replaced with new came. The new came matches the original in size and shape, but is made of an alloy of lead that has been demonstrated to be superior to lead used in the nineteenth century and the first half of the twentieth century. Releading may be done to the whole window, or it may be necessary only in certain areas.

Cleaning windows is a more complicated task than many might think. In plated opalescent windows, the only way to thoroughly clean the window is to totally dismantle it to get to the dirt between the plates of glass. This usually means that the panel then must be releaded. In cleaning stained-glass windows, the aim is to remove any dirt that is harmful without causing further damage to the glass or to the painted decoration. Sometimes it is not possible to remove all the dirt without losing precious painted details, and so the window may be left partially dirty. Solvents are often employed in cleaning windows, because water may be too harsh for fragile glass paint. On-site cleaning of single-layer windows can be done, but must be done carefully by conservators to ensure that fragile paint is not lost.

Edge-joining broken glass can be done several ways. One way is by gluing, with either epoxies or silicone adhesives. The other is by using copper foil and soldering the broken line together. Each technique has a different variety of pros and cons, making them appropriate for different situations.

Missing original glass must be replaced with glass that matches the original in color, both in reflected and transmitted light, and in texture. If the original glass was painted, the replacement glass must be painted to match it exactly. All replacement glass should be marked in some way so that future restorers can distinguish it from original glass with ease. The most permanent mark is by scribing or scratching the glass at the edge, where it will be hidden by the came. Usually the date and/or name of the conservator are marked.

When we recommend restoration in our comments below, we always include in this process removal and reinstallation of the window; cleaning; edge-joining of broken glass (unless stated otherwise); releading; and waterproofing. If we do not stipulate the extent of releading, we mean full releading.

WHAT TO EXPECT FROM A RESTORATION PROJECT

Interference with the interior operation of the building will occur if restoration is required, although its length and intensity will depend upon the amount of work elected to do at once and the location, size, and height of the windows to be restored.

We do not recommend any in-place repairs other than cleaning. When we recommend restoration, it is our intention that the windows will be removed from the building. This will require scaffolding of some kind on both interior and exterior sides. If the window is large or high, or if access is blocked by plantings, altars, raised platforms, or other immovable features, typically stained-glass contractors will require rented scaffolding. Most studios will provide their own scaffolding for windows located at aisle level, if the top of the window is not higher than about 25', although this may vary with the contractor. If a general contractor is involved with the project, provision of scaffolding is usually his responsibility. If the stained-glass studio is the primary contractor, the owner may elect either to rent the scaffolding themselves, or to have the stained-glass studio contract it, which will cost more but free the owner from involvement.

The exterior scaffolding may require some sort of enclosure to prevent unauthorized access. If site work is to take place during cold months, the exterior may require enclosure and heating.

The interior of the scaffolding should be enclosed to control dust and, to a limited extent, temperature. The owner must be aware that removal of historic stained-glass windows (any window installed before the mid-1970s) will generate a small quantity of lead dust (this lead is not from the caming, but from the setting putty). Qualified restorers will use HEPA vacuums to clean up the area. Most stained-glass con-

tractors are not qualified to provide OSHA-type measurement or control of lead. If lead dust is of concern to you, please feel free to contact your local OSHA office for advice. Contractors are expected to clean up the area prior to leaving the site, but a general increase in dust throughout the building should be expected (even when the scaffolding is tented).

Site work also generates a certain amount of noise, particularly during removal. Power tools and hammering are often required. Craftspeople often must shout to one another from levels of scaffolding and from inside to outside.

Removal of a single window usually requires one to three weeks, depending upon its size and setting. Once removed, the window will be taken off-site to the contractor's studio. The scaffolding may be removed or left in place: the decision is the owner's. Depending on its size and complexity, it may be less expensive to leave it in place during restoration. It will be required again for reinstallation. The window will be out of the building for at least several months. Reinstallation will require a similar amount of time as removal.

Site work should be scheduled during warmer months, especially reinstallation, because setting materials require overnight temperatures of 45° to 50°. Restoration schedules usually have site work occurring in the spring and fall. Windows are not adversely affected by extreme temperatures (they experience them in their settings all the time), but workers are: extreme cold makes handling glass difficult, and extreme heat is exhausting.

Use of the site by the contractor's employees is up to the owner. You may designate where their equipment is stored (typically they will require a locked room for overnight storage while they are removing and installing the window). You may also designate which bathroom, water, and electrical facilities they may use, and where they may eat. You may also designate the hours they can work. Often out-of-town contractors prefer to work 10-12 hour days, starting early in the morning. In religious buildings, they are used to working around the schedule of services and understand that unscheduled use of the building, like funerals, must take place. It is helpful if the owner can provide a schedule of uses, including things like organ practice that may involve only limited use.

The absence of the window may affect the use of the building. In religious buildings, for example, wedding photography will have to cope with missing windows and perhaps with scaffolding. There are various options for blocking the empty window opening. Typically, we specify painted plywood. On the exterior, we recommend a charcoal grey, which is the least visible and obtrusive. On the interior, grey may also be used, or the wall color may be selected. Alternatively, acrylic (Plexiglas®) or polycarbonate (Lexan®), clear or colored, may be substituted for plywood in all or part of the opening to provide some light. We have also had clients elect to have a photograph of the window reproduced at full size either as a transparency or on paper, which is affixed to the blocking material. (Our estimates include blocking with painted plywood only.)

During restoration, the owner should feel free to visit the contractor's studio to see the restoration in progress, although it is advisable to make an appointment for this, as most conservation studios are not prepared for walk-in visitors.

COST ESTIMATES

Estimates include removal; transport to a studio within 300 miles of the building; full releading and state-of-the-art restoration processes (including edge-joining, glass replacement, paint restoration, etc.); transport back to the building; and reinstallation. It also includes minor work to frames (scraping and repainting, weather-stripping and caulking). We have also included a 15% contingency.

There are also columns providing estimates for new protective glazing for the Tiffany and La Farge windows. Protective glazing estimates assume the use of laminated glass.

Estimates do not include scaffolding; major alteration to existing framing; or fabrication of new framing for protective glazing. They also not include project management costs. Estimates are valid for six months from the date of this report.

We make every effort to provide estimates that reflect the current status of high-quality restoration costs. We try to provide you with an estimate to serve as a ceiling figure. However, as in any estimate, actual contractor costs may vary from this substantially, due to factors over which we have no control, including the number of employees, overhead costs, and how much they want the work.

There is great diversity in the field of stained-glass contractors. Some studios are very large, with 30 or more employees. A typical restoration studio has 8-15 employees. There are many, many studios with one or two employees. Naturally, the costs of these types of businesses will vary. Experience and location are also factors in the cost of a studio.

The following spread sheet lists the windows, their sizes, and the costs for restoration and protective glazing.

Julie L. Sloan
Stained Glass Consultant
54 Cherry St., North Adams, MA 01247
(413) 663-5512; fax (413) 663-7167;
email jlsloan@jlsloan.com

Stained-Glass Restoration Estimate
Unitarian Universalist Church
121 N. Pleasant St.
Amherst MA

GRAND TOTAL: $ 398,322

Window Number	Location	Date	Lancet Ht	Lancet Wd	Lancet #	Transom Ht	Transom Wd	Transom #	Total Area	Priority	% relead	Stained Glass $/sf	Stained Glass Subtotal	Stained Glass 15% Conting.	Stained Glass Total	Protective Glazing $/sf	Protective Glazing Subtotal	Protective Glazing 15% Conting.	Protective Glazing Total	Stained Glass + Protective Glazing TOTAL
La Farge	St. John, Christ Preaching, St. Paul	ca. 1889	99	31	3				63.9	1	100	$ 2,300	$ 147,056	$ 22,058	*$ 169,115*	$ 100	$ 6,394	$ 959	*$ 7,353*	*$ 176,468*
Tiffany	Resurrection Angel	ca. 1890	85	31	3	15	31	6	74.3	1	100	$ 2,300	$ 170,823	$ 25,623	*$ 196,446*	$ 100	$ 7,427	$ 1,114	*$ 8,541*	*$ 204,987*
1	Interior Sanctuary	ca. 1893	48	24	1				8.0	1	100	$ 100	$ 800	$ 120	*$ 920*		$ -	$ -	$ -	*$ 920*
2	Interior Sanctuary	ca. 1893	48	24	1				8.0	1	100	$ 100	$ 800	$ 120	*$ 920*		$ -	$ -	$ -	*$ 920*
3	Interior Sanctuary	ca. 1893	48	24	1				8.0	1	100	$ 100	$ 800	$ 120	*$ 920*		$ -	$ -	$ -	*$ 920*
4	North Clerestory	ca. 1893	18	36	1				4.5	1	100	$ 100	$ 450	$ 68	*$ 518*		$ -	$ -	$ -	*$ 518*
5	North Clerestory	ca. 1893	18	36	1				4.5	1	100	$ 100	$ 450	$ 68	*$ 518*		$ -	$ -	$ -	*$ 518*
6	North Clerestory	ca. 1893	18	36	1				4.5	1	100	$ 100	$ 450	$ 68	*$ 518*		$ -	$ -	$ -	*$ 518*
7	North Hall	ca. 1893	28	44	1				8.6	1	100	$ 100	$ 856	$ 128	*$ 984*		$ -	$ -	$ -	*$ 984*
8	North Hall	ca. 1893	26	44	2				15.9	1	100	$ 100	$ 1,589	$ 238	*$ 1,827*		$ -	$ -	$ -	*$ 1,827*
9	North Hall	ca. 1893	26	44	2				15.9	1	100	$ 100	$ 1,589	$ 238	*$ 1,827*		$ -	$ -	$ -	*$ 1,827*
10	West Front doors	ca. 1893	18.5	7.5	4				3.9	1	100	$ 100	$ 385	$ 58	*$ 443*		$ -	$ -	$ -	*$ 443*
11	South Minister's office	ca. 1893	30	15.5	3				9.7	1	100	$ 100	$ 969	$ 145	*$ 1,114*		$ -	$ -	$ -	*$ 1,114*
12	South Community area	ca. 1893	38	32	1				8.4	1	100	$ 100	$ 844	$ 127	*$ 971*		$ -	$ -	$ -	*$ 971*
13	South Community area	ca. 1893	38	32	1				8.4	1	100	$ 100	$ 844	$ 127	*$ 971*		$ -	$ -	$ -	*$ 971*
14	South Community area	ca. 1893	38	32	1				8.4	1	100	$ 100	$ 844	$ 127	*$ 971*		$ -	$ -	$ -	*$ 971*
15	South Secretary's office	ca. 1893	44	20	1				6.1	1	100	$ 100	$ 611	$ 92	*$ 703*		$ -	$ -	$ -	*$ 703*
16	South Secretary's office	ca. 1893	52	22	1				7.9	1	100	$ 100	$ 794	$ 119	*$ 914*		$ -	$ -	$ -	*$ 914*
17	South Secretary's office	ca. 1893	52	22	1				7.9	1	100	$ 100	$ 794	$ 119	*$ 914*		$ -	$ -	$ -	*$ 914*
18	South Secretary's office	ca. 1893	52	22	1				7.9	1	100	$ 100	$ 794	$ 119	*$ 914*		$ -	$ -	$ -	*$ 914*

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GLOSSARY

Antique glass: Hand-made, mouth-blown glass.

Bench: The table on which a window is assembled, or glazed.

Came: H-shaped lead strips that hold the stained-glass window together. Glass fits between the parallel legs of the H.

Round came has a rounded profile on both sides.

Flat came has a flat profile on both sides.

Beaded came is flat with a ridge at the outer edges of the flanges.

Cathedral glass: Machine-rolled glass with imprinted texture on one or both sides.

Catspaw glass: An opalescent glass which is mottled with deeper colors; the mottling is said to look like the footprints of cats.

Cold paint: Paint applied to stained-glass windows that is not fired. It may be any of a variety of paints.

Dedication: The name and dates of the commemorated individual or group; as opposed to the inscription, which is the verse.

Enamel: In the context of this report, a fired glass paint that is translucent and colored, made of ground colored glasses.

Fillet: A narrow rectangular border.

Flashed glass: An antique glass that is made of two differently colored layers. A thicker base layer is usually a pale, transparent color, such as clear, yellow, green, or blue; a thinner flashed layer is usually a deep intense color, such as red or cobalt blue.

Flux: An acidic compound applied to metals to be soldered to clean the metal in preparation for soldering.

Full size: The overall size of the stained glass panel.

Grisaille: In the context of this report, a fired glass paint that is dense and opaque, made of metallic oxides, usually black or brown in color.

Grozing: A process for shaping glass pieces whereby a grozing iron or grozing pliers are used to chip away minute fragments of glass.

Head: The portion of the lancet above the spring line.

Inscription: The verse in the window; as opposed to the dedication, in which the commemorated individual or group is named.

Kite: A triangular or other shaped opening, usually small in relationship to the overall window, usually formed by tracery.

Lancet: A tall vertical window opening.

Liturgical orientation: In traditional liturgical orientation, the altar and chancel are located in the east.

Opalescent glass: Glass that is opaque or partially opaque, giving it the translucent qualities of an opal.

Plates, plated, plating: The layers or layering of one or more pieces of glass over others to create a window that is several layers thick.

Putty: See Waterproofing.

Quarry, quarries: regular geometric shapes repeated to form a window pattern; typically diamonds, but also squares, octagons, and other shapes.

Rabbet: sometimes also called "rebate": an L-shaped groove cut into a frame (usually wood or metal) into which the glass is set. The glass is held in place with moldings or putty bevels. See also "groove."

Saddle bars: A type of Support bar: saddle bars are applied to the surface of a stained-glass panel and should be set into the frame or sash to transfer the weight of the panel to the frame or sash; they are also important in keeping the panel from bowing laterally.

Solder: A lead-tin alloy that, when melted on the tip of a soldering iron, flows to metallic elements, such as came or copper foil, to hold the elements together when the solder cools.

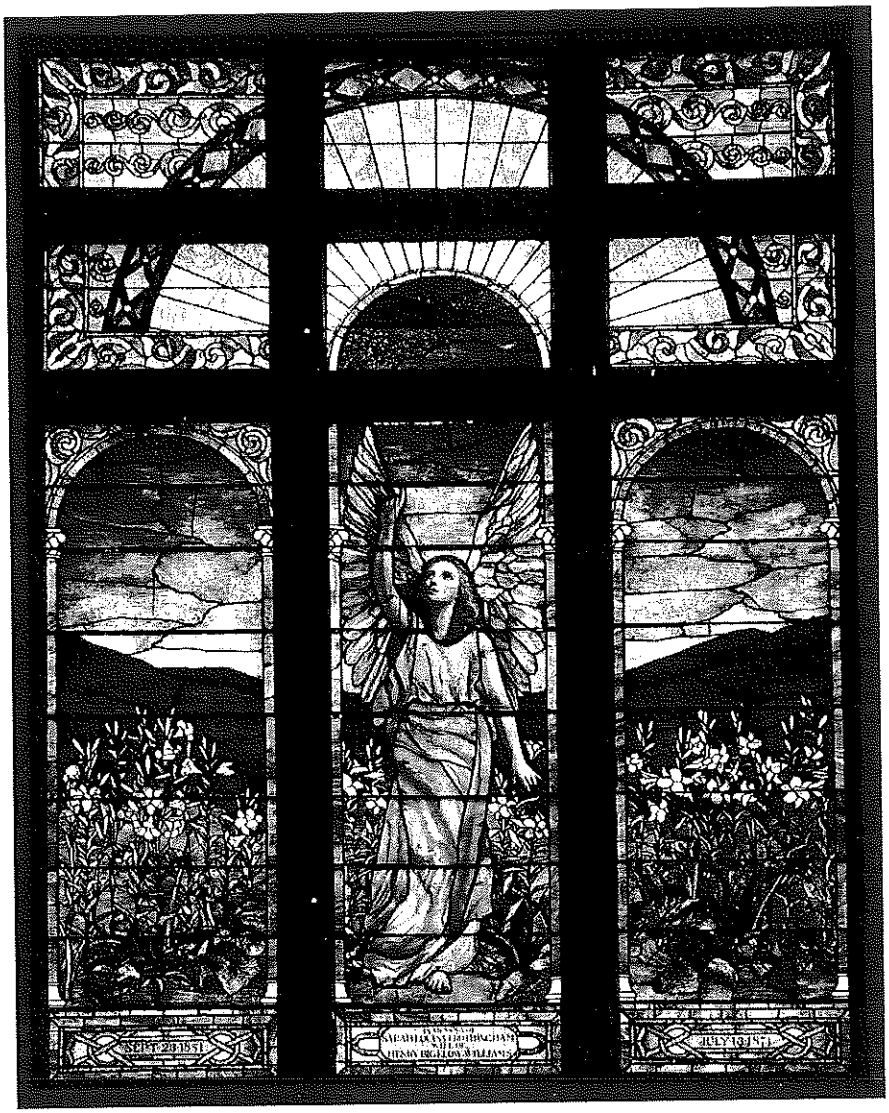
Strap lead: A piece of lead flange applied to a piece of glass to cover a crack.

Support bars: Saddle and T-bars used to support the stained-glass window in the window opening.

T-bars: Steel or iron bars in the shape of a T set on its side into the sash or frame; the stained-glass panel is set on top of the leg of the T.

Waterproofing, waterproofing compound, or putty: A thick putty or cement made of linseed oil and whiting, that is forced between the glass and lead came to prevent water and air from passing between them; it also stabilizes the stained-glass panel.

TIFFANY WINDOW



Tiffany Studios, *Resurrection Angel*, ca. 1890,
originally in All Souls' Church, Boston

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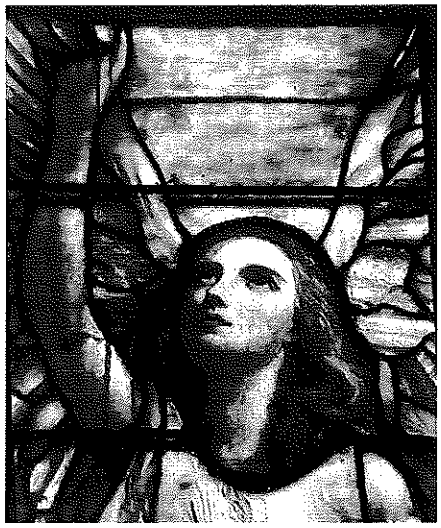
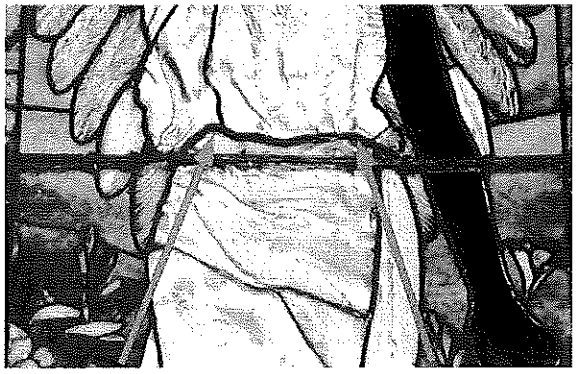
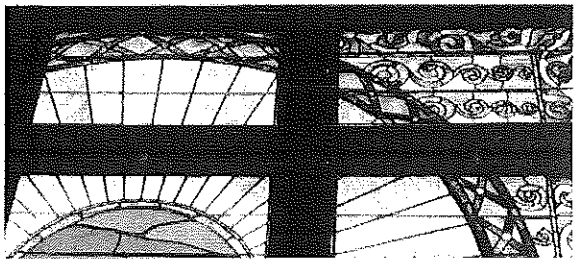


1. Painted face

2. Drapery glass



3. Meeting joint



4. Vents

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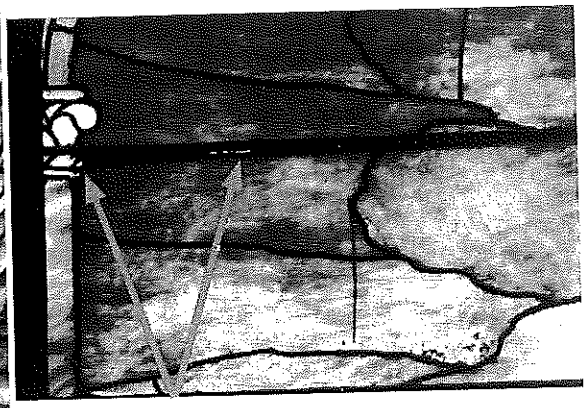
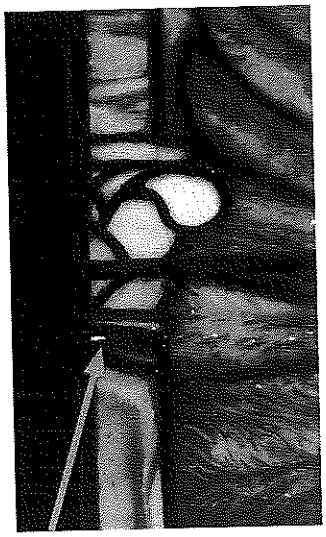
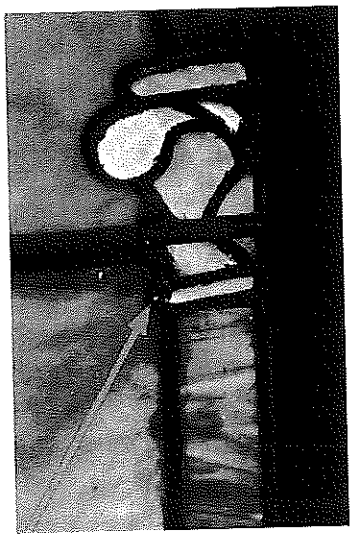
5. Light leak



6. Light leak



7. Light leak



8. Light leak

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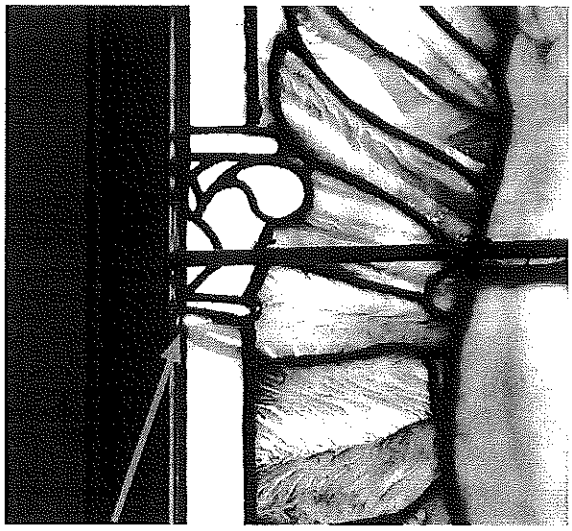
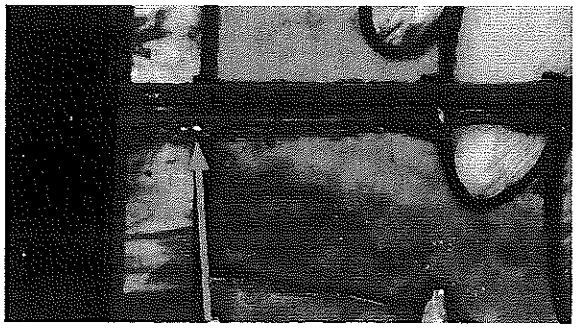
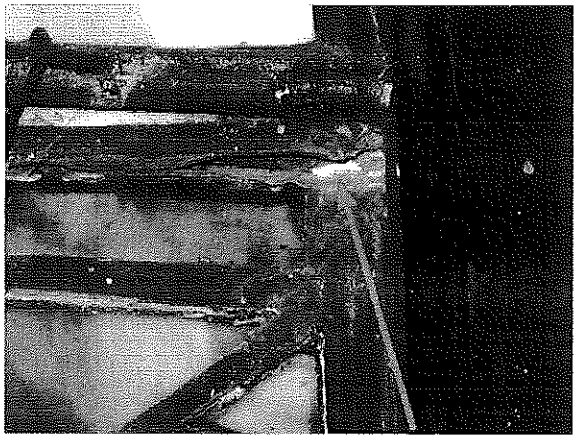


9. Light leak

10. Light leak



11. Light leak



12. Light leak

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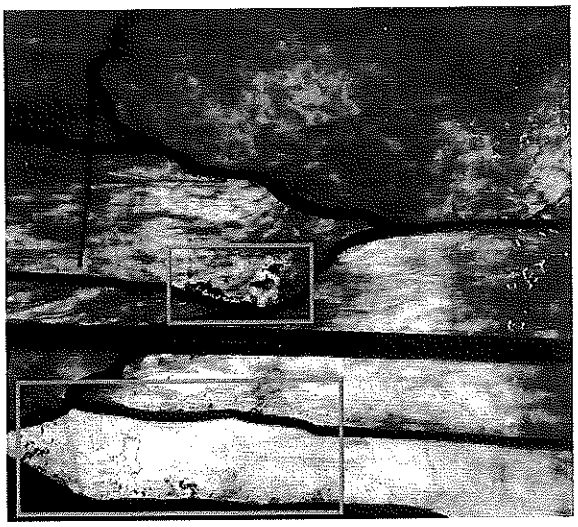
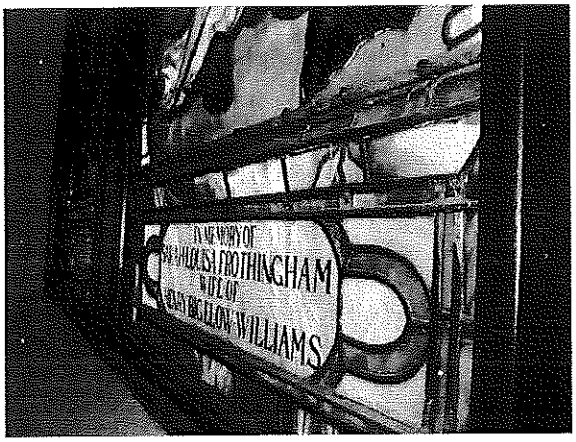
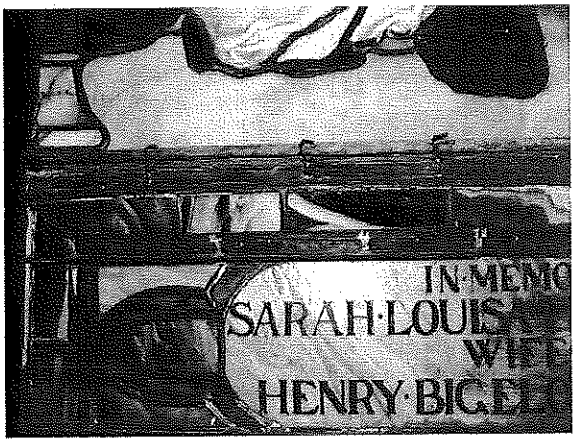
13. Dirt at bars



14. Dirt in plating .



15. Bowing



16. Bowing

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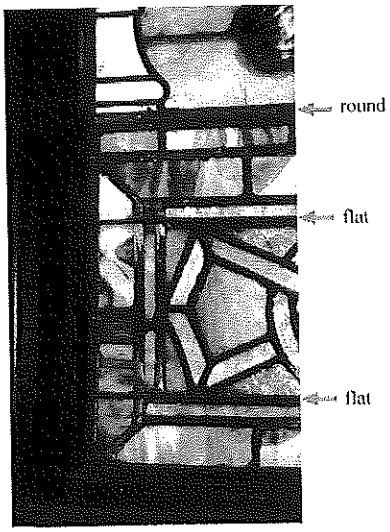

17. Round and flat bars

18. Protective glazing

19. Overlapped plastic

20. Loss of paint

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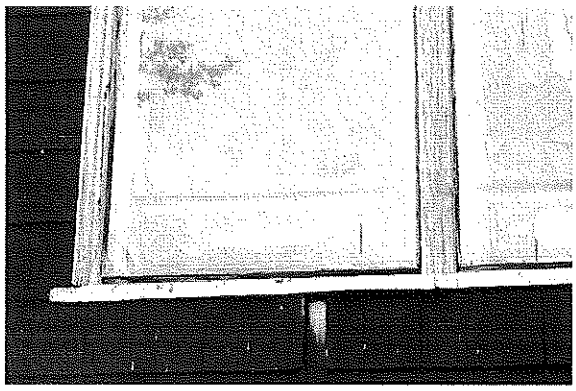

21. Sill detail

22. Wood condition

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WINDOW NUMBER:	Tiffany	PRIORITY: 1
WINDOW NAME OR SUBJECT:	Resurrection Angel	

DESCRIPTION

INSPECTION DATA	
Inspected by:	Julie L. Sloan
Inspection Date:	5/2/2006
Weather on Inspection Date:	Rain, 50 degrees
How was inspection done:	Up close

IDENTIFICATION	
Window Location:	Front
Window Orientation:	West
Window Date:	ca. 1890
Studio:	Tiffany Studios

TEXTS AND ICONOGRAPHY
Dedication:
Left: Sept. 23, 1851. Center: In Memory Of / Sarah Louisa Frothingham / Wife of / Henry Bigelow Williams. Right: July 13, 1871
Iconography:
Angel in a field of lilies

SIZE	
Overall Height:	135"
Overall Width:	108"

ORGANIZATION	
How many lancets:	3
Is there tracery:	Transoms
How many tracery openings:	6
Transom size (w x h):	31" x 15"

FRAMING AND SUPPORT	
Frame material:	wood
How is the window set:	interior

How many sections per lancet:	3
How many T-bars:	0
How many saddle bars:	10 per lancet, 2 per transom

Saddle bar size, profile, material:
7/16" round steel in lancets, 1/4" round steel in vents and transoms; 2 new 1/2" x 1/8" flat steel in vents"

VENTILATORS	
How many vents:	3
Location of vents:	Bottom of lancets, in all transoms
Vent-frame material:	Steel
Do vents open:	No
If not, why:	Protective glazing

MATERIALS	
Glass Type(s):	Opalescent
How many layers:	2 to 3
Came Metal Type:	Lead
Came sizes:	Various (no copper foil)
Decoration types:	fired paint, etching, enamels

PROTECTIVE GLAZING	
Is there protective glazing:	Yes
When was it installed:	30 years ago
What glazing material:	Plastic
What frame material:	None
How much space between stained glass and protective glass:	2 to 3 inches
Venting:	No
New protective glazing needed:	Yes

CONDITION

GLASS	
Number or percentage broken:	35%
Number or percentage missing:	Less than 20%
Dirt:	Severe

CAME	
Extent of corrosion:	Severe
Cracking:	Severe
Torn:	Severe
Bowing or sagging:	Moderate to severe
Percent to be replaced:	100%
Notes:	Window was relocated from Boston in the 1940s

STRUCTURE	
Saddle bars:	Rusty
Tie wires:	Poor
Vent frames:	Steel
Waterproofing:	Poor

Notes:
At Angel's waist, the meeting joint curves to follow the drapery, but the saddle bar is straight

GLASS PAINT	
Type of problem:	No
Location of paint problems:	

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WINDOW FRAME	
Setting putty or caulking:	Poor
Setting moldings:	Poor
Rot or loss:	Possibly in protective glazing and at sills
Water infiltration:	No

PROTECTIVE GLAZING	
Number or percentage broken:	Several pieces
Number or percentage missing:	None
Dirty or cloudy:	Yes

RECOMMENDATIONS

PRIORITY:	1. The window is in poor condition. Restore within the next two years.

RESTORATION PROCEDURES	
Glass:	Broken pieces should be edge-joined, not replaced. Missing pieces should be replaced to match the original, including painting.
Came:	The window will require 100% releading. Deteriorated came should be replaced with restoration-grade came to match the original.
Paint:	No glass paint restoration is required. No consolidation of glass paint is required at this time.
Saddle Bars:	If saddle bars are set deeply enough to provide adequate support, they may be retained. They should be repainted.
Frame:	Scrape, paint, replace deteriorated or rotting pieces
Protective glazing:	Replace existing with laminated glass with appropriate venting at the top and bottom of each frame opening. The exterior surface of the stained glass should be cleaned prior to installation of the protective glazing.

Note: This report is not intended to take the place of technical specifications for restoration.

ESTIMATED COST IN TODAY'S DOLLARS:	$204,987
Stained Glass Restoration Only:	$196,446
Protective Glazing:	$8,541

Estimates do not include scaffolding, project management, or annual increases for inflation or cost of living. This estimate reflects current prices in qualified stained-glass studios in the greater northeastern United States. Prices may vary locally, and with the size of the firm. Estimates are valid for six months from the date of this report.

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